

Symposium 5 (S05): Viticulture and Oenology: Living With Limitations

Monday · August 12

Location: Metro Toronto Convention Centre, Room 202CD

1100-1140

S05-0-1

PRECISION VITICULTURE—AN AUSTRALIAN PERSPECTIVE

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The accessibility and low cost of global positioning systems (GPS) means grape-growers can accurately locate themselves within their vineyard when sampling for vine growth, development and productivity. These data, when incorporated into maps give new interpretative power to measurements which may otherwise have been used to generate simple vineyard or regional averages. For example, grape yield maps tell growers where to look in optimising productivity. Maps of yield and various quality parameters identify potential zones for segmenting harvest, areas requiring fertilisation or differential irrigation management. Soil maps can be used to locate different varieties in a new vineyard site or aid in irrigation design. Measurement and mapping of these parameters is not confined to traditional on-ground sampling methodologies either. Emerging technologies involving on-ground, airborne or spaceborne remote sensing are attracting interest because of their potential for rapidly generating data of appropriate spatial resolution. For example, on-ground electromagnetic survey techniques provide an insight into soil texture variations and is a valuable tool in vineyard planning. Airborne or spaceborne digital imaging systems can delineate different levels of vine canopy vigour in an entire vineyard, providing up-to-date information on canopy development, the incidence of pests or diseases, and potentially aid in forecasting yield or fruit quality. This paper will describe the current status of precision viticulture research in Australia. Examples will be used to illustrate current benefits, as well as future opportunities, of existing and new technologies to aid in management at not only the vineyard but at an industry-wide scale.

1140-1200

S05-0-2

THE FEASIBILITY OF USING LYTIC PEPTIDES TO CONTROL PIERCE'S DISEASE

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Pierce's disease of grapevine is caused by the xylem-limited bacterium, *Xylella fastidiosa*. The bacterium multiplies within the vascular system and plugs xylem vessels. There is no cure for Pierce's disease. Methodology is available that allows for the application of various compounds to xylem vessels. There is much interest in lytic peptides with the discovery of cecropins, and concerns about antibiotics (tetracycline, streptomycin). The amphipathic structure of lytic peptides induces the formation of pores in lipid bilayers of prokaryotic cell membranes. Lytic peptides are an antimicrobial defense of many animal species and have minimal effect on eukaryotic cells. Lytic peptide genes have been utilized for enhancing disease resistance via genetic engineering. The technology has been patented for the introduction of Shiva-1 and SB-37 genes into tobacco and rice and Shiva-1 genes into Thompson's Seedless grapevines. Our objectives were to: 1) compare several peptides for efficacy against *X. fastidiosa*, and; 2) characterize the stability of lytic peptide in buffer and xylem fluid. The activity of cecropin A, cecropin B, magainin 1, magainin 2, lysozyme and tetracycline against *X. fastidiosa* after 1 hour incubation in vitro was determined. The concentration that completely inhibited *X. fastidiosa* was as follows: cecropins < 1 μM , magainin > 80 μM , lysozyme > 1,000 μM and < 100 μM tetracycline. The activity of cecropin A and B against *X. fastidiosa* was progressively reduced with time in xylem fluid of *Vitis rotundifolia* 'Noble'. The use of lytic peptides may be a feasible method to manage Pierce's disease if a continuous supply can be directed to xylem vessels.

1200-1220

S05-0-3

A GEOGRAPHIC INFORMATION SYSTEM FOR VITICULTURE IN THE OKANAGAN AND SIMILKAMEEN VALLEYS OF BRITISH COLUMBIA

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The Okanagan and Similkameen valleys in central British Columbia are home to a flourishing grape and wine industry. The high diversity of soils and terrain in the valleys are the result of several glacial episodes, the last ending 10,000 years ago. The most influential glacial and post-glacial activities were the periodic creation and breaching of an ice dam which led to the formation of silt benches and bluffs along the remaining Okanagan and Skaha lakes, and deposition of glaciolacustrine and fluvio-glacial materials that gave rise to silty, sandy, gravelly and stony soils. Although *Vitis vinifera* grapes have been cultivated in the area for decades, widespread planting of *V. vinifera* began in the early 1980s, and at present there are over 2,000 ha planted. The diverse soils and terrain, and their associated mesoclimates create a wide range of vineyard site conditions. Many growers have been successful in fine-tuning their viticulture to reach the potential for high quality fruit from their site, others struggle in selecting suitable varieties and in achieving optimum vine balance. A geographic information system (GIS) has been constructed to elucidate the relationships among site characteristics, viticultural practices, and grape and wine quality. Analyses of data models so far show the wide range of site characteristics that have demonstrated potential to produce quality wines, and the degree to which cultural practices may influence vineyard performance.

1220-1240

S05-0-4

SUSTAINABLE VITICULTURE: SURVEY OF TODAY'S VINEYARD STRESSES AND SUGGESTIONS FOR BETTER PERFORMANCE

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In Italian vineyards and elsewhere, a common concern is early vine senescence. During the past several decades, viticultural techniques have changed greatly, especially those growing techniques that have improved vigor and production. From 1980 present, research was carried out to understand the impact of vine stresses, especially those impacting vineyard longevity. Trials were carried out mainly in Piedmont and Lombardy, but several surveys were done as well in Venetia, Tuscany, Apulia, and also in France (Rhône Valley and Provence). For each selected vineyard the main observations were: climatic conditions, soil characteristics, and vineyard history (yield, vigor, pruning technique, soil management). The stresses recorded were: nutritional deficiencies, wood diseases, and FD-like symptoms. Results showed that in order to improve wine quality and vineyard longevity, more attention must be paid to: better balance between vegetation and grape production, improving soil structure, avoiding erosion and pollution, and amelioration of pruning techniques (dormant and green pruning), especially the avoidance of large trunk wounds. The future of profitable viticulture will be dependent upon more attention to better vineyard management techniques, with consideration paid to environmental concerns, for production of regionally-typical wines.

1340-1440

S05-P-5

XYLOGLUCAN ENDO-TRANSGLYCOSYLASE GENE IS CLOSELY RELATED GRAPE BERRY SOFTENING

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Partial cDNAs for cell wall degradation-related enzyme, xyloglucan endo-transglycosylase (XET) was isolated from a veraison-specific subtractive library made from Kyoho grape (*Vitis labruscana*) berries. During the development of Kyoho grape berries, the expression of the gene was analyzed. The XET gene expression was closely related to berry softening; slight XET gene expression was detected before veraison and was markedly increased at veraison (the stage

of the onset of berry softening). In addition, the expression of the gene was berry-specific. These observations suggest that XET plays an important role in grape berry softening. Full-length cDNA clone (VXET 1) encoding XET was isolated from a cDNA library of Kyoho grape berries and characterized. The deduced amino acid sequence of the VXET 1 showed 73.5% identity with the corresponding XET (NXG 1) from nasturtium (*Tropaeolum majus*) that has been shown to have endoglucanase activity. These findings suggest that the VXET 1 product cleaves a cellulose-xyloglucan network of cell wall and induces the softening of Kyoho grape berries at veraison. Using RTS-500 (Hitachi, Japan) system, we produced the recombinant protein of VXET 1 (rVXET 1) and determined its characteristics. Molecular mass of the rVXET 1 was 33 kDa. It was identified molecular mass of calculated from deduced amino acid of VXET 1.

1340-1440

S05-P-6

FURROW IRRIGATION OF VINEYARDS TO CONSERVE WATER IN CABORCA, SONORA

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An aquifer is the only available water for Caborca, Sonora (Mexico) and because most of the growers are using flood irrigation methods the aquifer is becoming depleted annually. Viticulture is the main activity in this area, with 14000 ha, half of which are flood irrigated. The objective of this study was to determine the effect of furrow irrigation on raisin vineyards. The furrow irrigation used at least 40% less water than flood irrigation. The yield was 8.2 kg/vine and 8.8 kg/vine (fresh grapes) for furrow and flood irrigation, respectively. Soluble solids were 24.0 and 23.4 and the drying ratios (fresh weight/dry weight) were 3.68 and 4.63 for furrow and flood irrigation, respectively. The cullage rates were 18% and 25% in furrow and flood irrigation treatments, respectively.

1340-1440

S05-P-7

PHOTOSYNTHETIC INHIBITION OF SEYVAL BLANC GRAPEVINES WITH TERBACIL

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Seyval blanc (*Vitis* spp.) is an important French-American hybrid white wine cultivar grown in the Great Lakes region due to its disease and phylloxera resistance and cold hardiness. It does, however, have some limitations. It forms large, compact clusters susceptible to Botrytis bunch rot under Michigan's cool, wet climate and post-rainfall veraison conditions. The large clusters can also result in overcropping (high crop loads) and delayed fruit maturity. Fruit thinning of most horticultural crops (peaches, apples, pears and grapes) is essential to achieve adequate fruit size and quality. Hand-thinning continues to be widely practiced, but increasing costs and decreasing availability of labor accentuate the appeal for chemical thinning agents. Terbacil (Photosystem II inhibitor herbicide), when sprayed at rates that defruited apple trees, caused no leaf injury, pygmy fruit, fruit malformation, or detectable residue levels in the fruit. Thus an application of Terbacil at flowering may decrease cluster size and compactness, alleviating disease pressure, overcropping and pesticide use. A whole-shoot open gas exchange system was constructed and used to measure carbon exchange in the field. Terbacil was applied 24 hours after the first CO₂ measurements at 40 ppm + Herbimax surfactant (10 mL·L⁻¹) on two shoots, and 50 ppm + surfactant (10 mL·L⁻¹) on another two shoots. The control consisted of a distilled H₂O⁺ surfactant (10 mL·L⁻¹) spray which was applied on four shoots. Terbacil inhibited photosynthesis by 80% initially and had an effect for three days. Thus, this preliminary study resulted in a decreased photosynthate production on a whole-shoot scale. Further studies are necessary to assess the true effects of Terbacil and the surfactant (crop oil) on grapevine photosynthesis, source-sink relation at bloom and potential for fruit thinning.

1340-1440

S05-P-8

EVALUATION OF THE NUTRITIONAL CONDITION OF ITÁLIA GRAPEVINES (PIROVANO 65) AT THREE DIFFERENT DEVELOPMENT PHASES IN THE REGION OF JUNDIAÍ, BRAZIL, USING THE DRIS METHOD

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This work aimed to evaluate the nutritional condition of Itália (Pirovano 65) grapevines growing in Jundiaí, State of São Paulo, Brazil, using the DRIS method. The nutritional survey was carried out in 19 vineyards by collecting leaf samples at three different development phases: bloom; between pea and half-berry; veraison. The yield was also considered in this evaluation. DRIS was useful and it allowed reliable information on sampling tissue, nutritional disorders and reference indices for nutritional balance. Leaf blades were better than petioles for tissue sampling, since it showed better nutritional balance indices. The method confirmed that bloom was the best stage for leaf sampling. Five vineyards were considered the most nutritionally balanced with above average yields of 20 t/ha and nutritional balance indices (NBI) of 11. The vineyards sampled were considered suitable for the calculation of means. DRIS also reflected the local sampling conditions and variability was found among the vineyards concerned with respect to degree of nutrient limitations and productivity.

1340-1440

S05-P-9

STUDY OF GRAPE GROWING POSSIBILITIES UNDER RAIN FED CONDITIONS WITH ONE OR TWO SUPPLEMENTARY IRRIGATIONS IN WEST AZERBAIJAN, IRAN

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Thompson Seedless, the most popular grape variety in Iran, is grown for table use, raisin and juice production. Due to a decrease in rainfall in different areas of the country, possibilities of continued grape growing in dry and semi-dry conditions was to be investigated. Therefore, Thompson Seedless was planted under rain fed conditions using a randomized complete block design with two factors including three depths of planting (60, 90 and 120 cm) and three irrigation schedules (without, once and twice annually), replicated three times within a factorial treatment arrangement. Observations were made over a period of 4 years. The results revealed that in spite of low annual rainfall (250 mm) grape growing under rain fed conditions was possible. Influence of depth of planting on yield was significant, and maximum yield was obtained in 120 cm depth. Influence of irrigation schedule on yield was not significant.

1340-1440

S05-P-10

SEASONAL PHOTOSYNTHETIC RESPONSE TO LIGHT INTENSITY IN FIELD GROWN SANGIOVESE AND MONTEPULCIANO VINES (*VITIS VINIFERA* L.)

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Canopy dry matter production was simulated using a simplified daily time step model, where daily photosynthetic integral is estimated from maximum net photosynthetic rate, daily integral of light, daylength, canopy extinction coefficient and leaf area index. This simple model also required knowledge of the photochemical efficiency. Basically, this variable was determined from the rectilinear portion of the light response curve and it is supposed to slightly vary along the season in different grapevines. In the present work, maximum net photosynthetic rate and photochemical efficiency were determined monthly in mature leaves of two winegrape varieties grown in Italy. Sangiovese and Montepulciano vines were cordon trained and spur pruned. Upright shoot growth was achieved by using foliage wires and shoot positioning. The vineyard was located in a south exposed hillside in Marche Region (central Italy). Montepulciano grapevines were more drought and high temperature tolerant in midsummer than Sangiovese that, on the contrary, had the highest photosynthetic efficiency under cooler temperatures in the first part of the season. After harvest, in September, both cultivars showed similar photosynthetic behavior. In conclusion, the seasonal dry matter production can be properly simulated with an accurate photosynthetic efficiency measurement, because its seasonal pattern during typical dry and warm Mediterranean summers is strongly variety-dependent and variety-specific.

1340-1440

S05-P-11

SELECTIVE FILTRATION OF SOLAR RADIATION BY COLORED SHADE NETS CAN IMPROVE THE YIELD AND QUALITY OF TABLE GRAPES

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A new approach for improving the utilization of the solar radiation by fruit trees was developed. The approach was based on plastic shade nets (cloths) of special optical properties, which modify the quality of the intercepting light, in addition to providing physical protection. The major aims were improving light penetration into the canopies and promoting desirable physiological responses, which are regulated by both the quality and quantity of light. Following the previously reported substantial effects of several colored nets on the elongation, branching and flowering of ornamentals, we applied the colored netting to vineyards. Low (20-30%) shading nets were used (compared with 50-80% shading in the ornamentals), to avoid reduction in productivity. A variety of colored net products were studied, each one specifically and differentially modified the spectrum of the filtered light (in the UV, visible or FR regions), and/or enhanced the relative content of scattered-diffused light, and/or affected the thermal components (the IR region), while inducing only minor effects on the vine microclimate. Experiments were carried out during the past two years in table grape vineyards, at two different locations in Israel, at a semi-commercial scale. The nets impacted growth rate, fruit maturation, cluster and berry size, sugar and acid content, color and external quality. Technological aspects of the colored net approach, potential benefits and future prospects were also investigated.

1340-1440

S05-P-12

STUDY OF MECHANISM OF PHLOEM SUGAR UNLOADING IN DEVELOPING GRAPE BERRY

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The phloem sugar unloading in developing grape berries (*Vitis vinifera* x *V. labrusca* cv. Jingchao) was studied with "berry cup technique" and chromatography methods. The results showed that glucose and fructose accounted for 70% or more of the total 14 °C-photoassimilates unloaded from phloem of the berries, but sucrose only accounted for 22% to 25%. The sugars loaded into the flesh sink-cells could be quickly metabolized. The optimum pH of the unloading buffer solution was 5.5, and phloem unloading was inhibited by lower pH values, but increased by short-term (20 min.) treatment with pH 6.5 to 8.5. The phloem unloading was facilitated significantly by 20 µmol/L fusioicin or 1 mmol/L 1,4-dinitrophenol but the phloem unloading or the post-phloem transport was inhibited by 5 mmol/L NaF or 5 mmol/L NaN₃. The phloem unloading was obviously enhanced by 10 mmol/L ethyleneglycol-bis-(β-amino-ethyl-ether)-N,N'-tetraacetic acid but it was inhibited by 25 mmol/L CaCl₂. The phloem unloading was also increased by either 0.1 mmol/L ABA or 0.1 mmol/L IAA. The effect of ABA appeared prompt but temporary, and that of IAA tardy but lasting. The results indicated that the major site of sucrose hydrolysis was within the phloem of the berry, and that glucose and fructose were the two main kinds of sugars loading into the flesh cells. Mechanisms of the sugar transport across plasma membranes and the action of ABA and IAA on phloem unloading in grape berries are postulated.

1340-1440

S05-P-13

EFFECTS OF COVER CROPS ON GROWTH CHARACTERISTICS AND UNDERGROUND ENVIRONMENT OF VINEYARDS

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To ascertain long-term effects of rye and other cover crops on grapevines, experiments were carried out in the vineyards of the Youngdong County and the National Horticultural Research Institute in Suwon City, Korea. The first experi-

ment was to address the weak growth of grapevines resulting from 3 years of rye growing and to encourage rye as a continuous cover crop compared to conventional tillage. Growth characteristics of grapevines did not differ between rye growing for 3 or 6 years. Cluster weights, berry weights, soluble solids and berry color were higher in rye treatments (both 3 and 6 years) as compared to tillage. Mineral elements were higher in rye-cropped soils after 6 years as compared to those cropped for 3 years and those subjected to tillage. Soil microbes except thermophilic *Bacillus* spp. and Actinomycetes were dense in soils cropped with rye for 6 years. The second experiment was to select cover crops for grapevines. Cover crop coverage rates were highest in wild grass, rye and orchard grass, while dry weights were heaviest in rye and hairy vetch. Cutting time was 17 May for rye, while hairy vetch died naturally by the end of June. Root weights were highest in rye, barley, and orchard grass. There was no difference in the soil pH among the cover crop plots, but organic matter varied between 0.7 and 1.8%. Red clover and wild grass plots displayed highest levels of most nutrient elements, although rye plots had the most K, Ca and Mg. The population of thermophilic *Bacillus* spp. was highest in red clover plots, while that of mesophilic *Bacillus* spp. was highest in wild grass and tillage treatments. The density of aerobic bacteria and fluorescent *Pseudomonas* spp. was highest in orchard grass and hairy vetch. Nematodes were most abundant in hairy vetch, barley, and red clover, in that order. Highest berry weights, soluble solids, and anthocyanins were observed in vineyard treatments with cover crops except those where red clover and wild grass were used.

1440-1500

S05-O-14

USE OF RAPD MARKERS TO IDENTIFY FRUIT COLOR IN GRAPEVINE: FIRST RESULTS

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Grapevine cultivation in Piemonte (North-west Italy) is largely for the production of both red and white V.Q.P.R.D. wines. Grapevine berry color can be white, red or black due to the presence of anthocyanin pigments in the epidermal cells. Many authors have suggested that the red color is controlled by a single dominant gene. The use of molecular markers can be an objective method for identification of characters such as color in the selection of new varieties and for the characterization of vegetatively propagated material. It can also be helpful to assist breeders in selecting desirable genotypes. Studies for the identification of molecular markers for berry color determination were carried out. RAPD analysis and Bulk Segregant Analysis (BSA) were chosen for the quickness and reliability of the results even on young material. BSA was used to detect a specific RAPD marker for certain characters within pools of individuals or progenies. Twenty winegrape cultivars, 10 each with white and black berries, were examined using RAPD and BSA. DNA was extracted from young leaves harvested in a collection field located in Grugliasco (Piemonte). A total of 120 oligonucleotide primers (10-mers) from the kits A, I, J, M, O, P, and Y from Operon Technologies were tested on two pools of DNA isolated, respectively, from the white-berried and black-berried cultivars. Twenty-one of the tested primers produced polymorphic bands in the size range between 250 bp and 3000 bp. Preliminary analyses of BSA seemed to have detected a specific RAPD marker for color in the kit M.

1500-1520

S05-O-15

TO BE ANNOUNCED

1520-1540

S05-O-16

VINEYARD LOCATION ANALYSIS FOR SITE SELECTION AND EVALUATION

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Vineyard site selection for production of wine grapes requires special at-

tention to ensure wines of desired style and quality are produced, and to tailor vineyard management practices to maximize site potential. On the basis of detailed analysis of local environmental conditions, this paper proposes a regionally-based numeric site indicator that enables precise vineyard site evaluation. The results of site environmental characterization and vineyard production and quality potential are presented for the following wine regions: Hawke's Bay (New Zealand), Mornington Peninsula and Cowra (Australia).

1540-1600

S05-0-17

TO BE ANNOUNCED

1600-1620

S05-0-18

GRAPE NUTRITION MANAGEMENT SERVICE: A MATHEMATICAL MODEL AND DATABASE FOR COMMERCIAL CONSULTANCY

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A mathematical model linked to a database, known as the Grape Nutrition Management Service (GNMS) has been developed for application of nutrition management advised to improve grape industry in the province of Zanjan (Iran), which is one of the country's main grape production areas. This practical modal summaries mineral flux within the grapevine and derives a budget of the amount of any mineral requirement. Monitoring of the grapevine nutrient status, with plant and soil analysis, provides further refinement of the fertilizer program, and determination of mineral deficiencies. Nutrients required to correct any deficiencies or disorders are determined according to a calculated budget. This budget accounts for uptake, efficiency of fertilizer recovery, cycling within the vineyard, and the background deficiency. All required data was gathered from complete description of dynamics within individual grapevines over 3 years (1998-2000). This database can be considered as a valuable research resource, for examining mineral dynamics within individual grapevines and general nutritional relationships for grapes.

1620-1640

S05-0-18-A

TO BE ANNOUNCED

1640-1700

S05-0-18-B

TO BE ANNOUNCED

Tuesday · August 13

1100-1140

S05-0-19

GRAPEVINE WATER RELATIONS AND IRRIGATION: A CASE STUDY IN THE HUMID CLIMATE OF THE NORTHEASTERN U.S.

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The water relations of grapevines are affected by many physical, physiological, cultural and environmental factors. The optimal level of vine water stress will vary with the use (fresh juice, table or wine) as well as the climate and soils. Juice and table grape production typically require less stress to allow high production levels and/or large berry size. Wine grapes typically do best with an intermediate stress levels although the optimal amount and timing of stress for best wine quality is controversial. Excessive stress can be negative to both fruit yield, fruit/wine quality and sustained cropping. In arid climates the need for irrigation is generally obvious, so the focus is on amounts of irrigation needed and regulation of vine stress, especially for wine quality. However, in humid climates the need for irrigation is not clear. Consideration of the components of vineyard water balance and how they can be manipulated can

be used to estimate relative risk of significant water stress and feasibility of irrigation. Results of water stress and irrigation studies in the humid, but erratic, climate of the Northeastern U.S. will be used as a case study.

1140-1200

S05-0-20

RESPONSE OF *VITIS VINIFERA* CV. BOBAL AND TEMPRANILLO TO DEFICIT IRRIGATION

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Experiments on drip deficit irrigation were simultaneously conducted in two representative commercial vineyards in Requena (Valencia, Spain), during the 2000 season, when total rainfall was only 250 mm. Each vineyard was planted to one of the main grapevine varieties cultivated for red wine production in the area, Bobal and Tempranillo. Treatments consisted in a rain-fed control (T1), and several (four and six, respectively for Bobal and Tempranillo) irrigation treatments, where water was applied at different levels during the following periods: i) flowering to fruit set; ii) fruit set to veraison, and; iii) veraison to fruit maturity. The irrigation treatments for Bobal were: T2 (50-50-0); T3 (100-100-0); T4 (100-100-50), and; T5 (100-100-100), and for Tempranillo: T2 (0-66-0); T3 (0-100-0); T4 (100-33-0); T5 (100-66-66); T6 (100-100-33), and; T7 (100-100-66), where the numbers are the percentages of the estimated ET_{crop} applied in each of the three phenological periods. The experimental design was a completely randomized block with four and six replicates of 64 and 100 vines per plot for Bobal and Tempranillo, respectively. The effects of this differential irrigation on vine water status, yield, berry growth and composition, and red wine quality variables were investigated. Contrasting responses were observed between the two cultivars.

1200-1220

S05-0-21

PAPER MILL FIBRE RESIDUE IS BENEFICIAL FOR AMENDING HIGH DENSITY SOIL AND QUARRY OVERBURDEN FOR USE AS VINEYARDS

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In 1999, an unproductive section of a limestone quarry was rehabilitated using paper mill fiber residue (PMFR, C:N ~50:1) to improve soil structure. PMFR was added at 0, 180, 360 wet t/ha (~50% moisture) in a one time application. Soil bulk density improved in the PMFR plots (overburden = 2.3 g/cubic cm; after PMFR incorporation = 1.2 g/cubic cm). Soil percolation rate also improved in 1999 (after grading = <10 minus 6 cm/s; after PMFR incorporation = 2.1 x 10 minus 3 cm/s), but rates returned to background levels by spring 2000. In November 1999, cover crop analyses (N and K percentage of dry wt) decreased with increasing PMFR application rates. In Spring 2000, cover growth was generally deficient but not significantly affected by PMFR application rates, suggesting the negative effects of PMFR application on soil chemistry and the positive effects on soil structure were temporal under these conditions. In another site, PMFR was applied at 0, 60, 90 and 120 wet t/ha in Fall 1997, Spring and Fall 1998, spring and Fall 1999 and Spring 2000, for a cumulative total of 0, 360, 540 and 720 wet t/ha. Vines were planted in July 2000 and N applied at rates calculated to bridge the potential N deficiency predicted from the Spring 2000 PMFR application rates. Residual soil N and vine tissue N were not affected by PMFR application rates. Fertilizer use efficiency and plant biomass were maximized at 60 wet t/ha and at least 60 kg/ha N. PMFR additions have been beneficial as amendments for high density soils, but must be applied regularly to sustain soil structural improvements. Also, N addition is necessary if application and planting are to coincide, and should be calculated using the specific C:N ratio of the PMFR sample to be used, since individual mill residues vary widely depending on the paper making process.

1220-1240

S05-0-22

GRAPEVINE PHLOEM SAP ANALYSIS: 1- SUCROSE, AMINO ACIDS, POTASSIUM CONCENTRATIONS. SEASONAL AND DIURNAL PATTERNSM. Gholami*¹, B.G. Coombe², S.R. Robinson³

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Sucrose, amino acids and mineral ions were analyzed in phloem exudates collected from three grape cultivars. The sucrose concentration in the phloem exudates from different cultivars was found to be high, while glucose and fructose were low. In addition to sucrose, substantial levels of amino acids and potassium were also detected in the exudates. Glutamine was the principal amino acid in the phloem exudates of grapevines followed by glutamic and aspartic acids, and alanine. Omission of EDTA from the buffer solution or girdling of canes either side of the bunch greatly decreased the levels of all these sugars and amino acids in the exudates. These controls together with the observed composition of the collected mineral, suggested that the exudates were predominantly derived from phloem sap entering berries from the lateral shoots. The metabolites exuded from the phloem of fruit bunch stem (peduncle) showed seasonal and diurnal variations. The diurnal pattern of sucrose exudation showed high levels of sucrose exuded at night. Total amino acids and some individual amino acids also showed diurnal variation.

1340-1440

S05-P-23

INFLUENCE OF ABA AND ETHEPHON TREATMENTS ON FRUIT COMPOSITION OF TEMPRANILLO GRAPEVINESRuben Delgado¹, Jose-Ignacio Gallegos¹, Pedro Martín¹, Maria Rosa González*²

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In cool regions, where heat units are frequently insufficient for grape maturity, it may be appropriate to use growth regulators to accelerate fruit maturity and to enhance color of musts. The effects of combined treatments of ABA (abscisic acid) and ethephon (2-chloro-ethylphosphonic acid) on fruit composition of Tempranillo grapes were examined. The experiment was conducted in Ribera del Duero (Spain) in 2001. ABA and ethephon were applied at veraison (98% berries colored). Vines were sprayed with ABA at 0, 400 and 800 ppm and with ethephon at 0 and 700 ppm. The experimental design was a randomized complete block with four replications. At harvest, berry weight, total soluble solids, pH, titratable acidity (TA), total polyphenols and chromatic characteristics of must were measured. ABA treatment at 400 ppm increased must pH and decreased hue, but had no effect on other fruit composition variables. Contrary to previous studies with other cultivars, ethephon application improved berry weight and increased the total soluble solids content of Tempranillo grapes at harvest (23.0%) in relation to control (22.5%), and increased the soluble solids:TA ratio. Ethephon also improved color density and the red component of must color.

1340-1440

S05-P-24

EFFECT OF PLASTIC COVERING ON THE LENGTH OF THE GROWING CYCLE OF NIAGARA ROSADAEster Alice Ferreira*¹, Murillo de Albuquerque Regina², Luís Eduardo Corrêa Antunes³

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The grapevine cultivar Niagara Rosada (*Vitis vinifera* L. x *V. labrusca* L.) is one of most popular table grapes in Brazil. The harvest, in some areas, is concentrated at parts of year, making necessary some practices to manipulate the growth cycle. This work was carried out to evaluate the effects of plastic covering on the length of the growth cycle of Niagara Rosada, and its behavior under this protected cultivation. The experiment was in an established vineyard in Caldas County, MG (Brazil). Vines had been previously treated with hydrogen cyanamide to break

dormancy. Treatments were: early pruned, with and without plastic covering; with and without irrigation; conventionally pruned. The measured variables were: total length of the growth cycle; beginning and end of the phases of the phenological cycle: budburst, bloom and fruit maturation; degree-day accumulation from pruning to fruit maturation; yield and cluster number per vine; Brix, titratable acidity (TA), and pH (based upon 20 clusters per treatment). The use of the plastic covering did not reduce the length of the growth cycle but increased degree-day accumulation. There were no differences between treatments with respect to time of budburst. Vines covered in plastic had fewer clusters per vine, lower yields, and lower Brix, but there were no differences in pH or TA.

1340-1440

S05-P-25

THE USE OF A FREEZING BUD TECHNIQUE TO DETERMINE THE HARDINESS OF 20 GRAPE GENOTYPES

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Pencil thick canes from 20 different grape genotypes were harvested at three different dates in the fall (October, November and December). The genotypes had previously been classified as hardy (group A), semi-hardy (group B) or tender (group C) based on information collected in the literature. Individual bud sections of the canes were placed in a refrigeration unit and subjected to sequential freezing temperatures (-7 °C, -15 °C, -22 °C and -30 °C) for 24 hours at each temperature. Samples were removed after each freezing cycle to evaluate the survival of the buds. Results for the samples taken in October showed that almost 100% of the buds were killed once they were subjected to -22 °C or colder. The critical temperature appeared to be -15 °C where there was a marked difference in survival between the three groups of genotypes: percent mortality was 39%, 50% and 94% for groups A, B, and C, respectively.

1340-1440

S05-P-26

EFFECT OF NON-CONVENTIONAL GROUND COVERS ON GROWTH OF CONTAINERIZED SEYVAL BLANC GRAPEVINES

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Container grown, own-rooted Seyval blanc grapevines (*Vitis* spp.) trained to a single shoot with one cluster were grown with seven different ground covers and a control of no ground cover. The ground covers were also grown without grapevines. The ground covers had no effect on total dry weight of the grapevine and no effect on the dry weight of the shoots, petioles and roots. Grapevine total leaf area was only diminished significantly by English pennyroyal. There was no effect by the ground covers on the cluster characteristics or the pH, titratable acidity, and soluble solids levels of the juice. At the end of the growing season, mazus and English pennyroyal had produced twice the dry weight of creeping thyme and veronica, with companion grass, strawberry clover, and Kentucky-31 being intermediate. At destructive harvest, strawberry clover and Kentucky-31 had over 40% of their total root biomass located in the bottom half of their pots; companion grass and veronica between 21% and 23%, while English pennyroyal, mazus, and creeping thyme grew less than 15% of their roots in the bottom half of their respective pots. Mazus and English pennyroyal gave the earliest complete coverage of the soil surface, while companion grass, creeping thyme, and Kentucky-31 never reached complete coverage in the 14 weeks of the experiment. Strawberry clover had the highest amount of above-ground growth removed during the growing season, followed by English pennyroyal, Kentucky-31, and companion grass. Much less above ground growth was removed from mazus and veronica, and none was removed from creeping thyme. The competition from the grapevine resulted in a 20% reduction in the growth of the ground cover, and this effect was seen across all ground covers.

1340-1440

S05-P-27

MYB GENES OF KYOHO GRAPE (*VITIS LABRUSCANA*) ARE DEEPLY INVOLVED IN THE REGULATION OF ANTHOCYANIN BIOSYNTHESIS IN GRAPEShozo Kobayashi*¹, Megumi Ishimaru², Kentaro Hiraoka³, Chikako Honda⁴

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Partial cDNAs for myb-related regulatory genes were isolated from the Kyoho grape and their expressions were studied. Since the expression of a myb-related gene, MybA, was closely related to the coloring and/or ripening of the berry (the expression increased dramatically as coloring and berry softening began and was detected only in the berry skin and flesh), the full-length cDNAs for the MybA gene were isolated from a mature berry cDNA library. The cDNAs were composed of three different species. When these cDNAs were delivered to the somatic embryos of the grape, they induced reddish-purple spots and the expression of a UDP-glucose:flavonoid 3-O-glucosyltransferase (UFGT) gene in the non-colored somatic embryos. In the control embryos, the UFGT transcript was not detected, and other structural genes for anthocyanin biosynthesis were expressed in both the control and pigmented embryos. These results suggest that MybA genes are deeply involved in the regulation of anthocyanin biosynthesis in grapes via expression of the UFGT gene.

1340-1440

S05-P-28

EFFECTS OF MACRO AND MICRONUTRIENTS ON FRUITFULNESS AND SOME QUANTITATIVE AND QUALITATIVE TRAITS OF SULTANA GRAPES

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Type and rate of macro and micronutrients affect different factors including leaf area, plant growth, fruitfulness, and fruit quality. Also, fruitfulness of different buds on a cane varies between cultivars. The objective of this trial was to devise suitable fertilization recommendation for the region's weather conditions, to increase bud fruitfulness, and to establish a balance between vegetative and reproductive growth of the vine. It was essential to prevent the expression of deficiency symptoms while at the same time avoid soil pollution caused by excessive application of fertilizers. Various combinations and rates of urea, triple superphosphate, potassium sulfate, sulfur, Fe and Zn sulfate fertilizers were combined in a factorial treatment arrangement within a randomized complete block experiment and applied on Sultana seedless grapevines trained to bilateral cordons. Use of microelements (Fe, Zn, S) together with nitrogen and phosphorus increased percentage of bud break, fruitful shoots, cluster weight, berry weight, and overall yield.

1340-1440

S05-P-29

GRAPE LEAF DIAGNOSIS STANDARDS IN COMPARISON TO PEDOLOGICAL FACTORS

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Piedmont is the third largest region in Italy in terms of grape and wine production. About 90% of the production is obtained from vineyards managed by integrated production methods. This has increased the popularity and use of foliar diagnosis as a complement to the fertilization planning in order to maintain consistent and high yields. For proper interpretation of leaf analysis it is required to establish reference standards that take into account the local soil, weather and genotype (cultivar and rootstock) conditions. This kind of information has been lacking on a regional basis, although for some growing regions and cultivars similar work has been conducted. This paper reports on the results from the two main cultivars grown in Piedmont, Nebbiolo and Barbera, which provide the raw material for several kinds of wines. The study started with a general survey of the nutritional status of these varieties using data from the Laboratorio Agrochimico and the SAGEA data banks of soil and leaf analyses. At the same time, 120 vineyards were selected considering vegetative growth, yield, must composition and

absence of nutrient deficiency symptoms. The vineyards were located in the different growing areas for the two cultivars based upon the DOC and DOCG delineated wine zones. Standard soil and leaf analyses were carried out on samples gathered from these vineyards. Yield and composition of the grapes were also determined. Data were analyzed statistically to determine the frequency distribution of the different nutrients. To assess the relationships between genotype and pedo-climatic conditions, different correlation methods were applied. Concentrations of certain elements were in some cases correlated to yield and composition variables. As a result, a leaf reference standard for these cultivars in the Piedmont was developed and a correlation with soil classification is proposed.

1340-1440

S05-P-30

IN-ROW VINE SPACING AFFECTS VINE YIELD INDEPENDENT OF BUD LOAD FOR FIVE WINE CULTIVARS OF *V. VINIFERA* L.

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Five cultivars of *Vitis vinifera* L. (cv Cabernet Sauvignon, Chardonnay clone 96, Pinot noir clone 115, Gamay noir, Riesling clone 239), all on Couderc 3309 rootstock, were planted at one row spacing (2.5 m), three in-row vine spacings (0.85, 1.20 and 1.50 m) and pruned to two different bud loads (8 and 12 buds/m²) using a spur pruned, low cordon training system. Yield components and fruit composition were examined from 1997 to 2001. Yield per vine was directly related to vine spacing but not bud load, except for Riesling. Yield per m of row and per m² were not affected by either vine spacing or bud load; again, except for Riesling. There were no interactions between bud load and vine spacing for any of the five varieties for yield per vine, yield per m row or yield per m². Yield of fruit per bud retained was highly significant for bud load for all cultivars, and for vine spacing with Cabernet Sauvignon, Pinot noir and Riesling. There was no interaction between vine spacing and bud load with respect to bud yield. Vine spacing and bud load appeared to be acting independently in terms of their impact on yield. In 2000, vine spacing impacted fruit health and the quantity of crop lost to powdery mildew for Cabernet Sauvignon, Chardonnay and Gamay noir, particularly at 0.85 m compared to 1.2 m and 1.5 m. Pinot noir and Riesling were overwhelmed with mildew throughout the experiment and showed no differences due to vine spacing. Crop efficiency and fruit were also impacted.

1440-1500

S05-O-31

PHLOEM UNLOADING IN THE DEVELOPING GRAPE BERRY: AN IN VIVO TECHNIQUE FOR THE STUDY OF PHLOEM SUGAR UNLOADING AND AN UNLOADING MECHANISM

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There is a fragile cell layer between the grape berry epidermis and the region of dorsal vascular bundles. The berry's skin can be easily peeled off, and the dorsal vascular bundles can be well exposed without damage, so that these sites of phloem sugar unloading can be directly accessed by a buffer solution or regulators in "berry cups". An in vivo experimental system was established, utilizing a "berry-cup" technique, which allowed the study of phloem unloading in developing grape berries by incubating the peeled berry in a buffer solution. ¹⁴C-assimilate was transported into the berries 1 h after labeling the leaf at the same node and opposite to the berry bunch with ¹⁴CO₂. The rate of phloem sugar unloading from the peeled berry remained stable for 2.5 to 4 h after labeling the leaf. The accumulation kinetics of ¹⁴C-assimilate in the whole berry was consistent with that in the buffer solution of "berry cup", which indicated that peeling the berry did not affect the phloem sugar unloading. ¹⁴C-assimilate unloading from the phloem originally accumulated in extracellular free space in the berry pericarp. The sugar loaded in the flesh cell did not efflux out. The optimum pH of the unloading buffer solution was 5.5. The phloem unloading was inhibited by 25 mmol/L CaCl₂, but it was not affected by 2 mmol/L CaCl₂. Phloem unloading was reduced significantly by adding 2.5 mmol/L PCMBs [p-chloromercuriphenylsulfonic acid] in the buffer solution. This result indicated that the phloem unloading in developing grape berry was mainly via the apoplastic pathway, appearing to be an active process that was mediated by sugar transport

carriers. It was demonstrated that "berry cup technique" is a feasible and reliable experimental system for the studies of sugar unloading from phloem in the fruit.

1500-1520

S05-O-32

CONCORD GRAPE RESPONSES TO WATER STRESS IN A COOL HUMID CLIMATE: GROWTH, PRODUCTIVITY AND PHYSIOLOGY

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A trial of balanced versus minimal pruning with and without supplemental irrigation was established in a mature Concord (*Vitis labruscana* Bailey) vineyard in Fredonia, NY in 1990 and has continued to the present. The variables monitored each year were: soil moisture, shoot and berry growth, vine pruning weight, yield components, and fruit quality. Since 1997 we have also monitored soil temperature and new root production and lifespan with clear root observation tubes with a video mini-rhizotron. Six of the 12 years had significant drought periods, and three of them have been severe. Overall, minimal pruning gave higher and more stable yields than balance pruning, but fruit Brix levels were lower. Drought stress had its most negative effects on the minimally-pruned vines, but few long-term effects of drought stress were observed on the balance-pruned vines. In response to water stress, shoot growth rates and total pruning weights declined, as did water potentials and leaf photosynthesis. Fruit growth shortly after bloom was reduced with early drought, but generally the mid to late-season droughts had little effect on berry growth until the last 2-3 weeks before harvest. Root production varied with yields, and had varying patterns of root production in different years. Root production was not affected much by pruning, but was strongly reduced by drought, especially droughts in consecutive years. In the second year of drought, irrigated vines produced three times as many new roots as non-irrigated vines. Root longevity appeared to be shortened by dry soil. Carry-over effects of drought stress differed with pruning. Following droughts, balance-pruned vines had lower pruning weights, so fewer buds were left and yields the next year were reduced, but the good quality of the basal buds provided some yield compensation. However, minimally-pruned vines retained all nodes so yields varied by reductions in total live nodes and average node quality.

1520-1540

S05-O-33

QUALITY OF MERLOT GRAPES AS AFFECTED BY DIFFERENT SOIL WATER AVAILABILITIES

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The amount of soil available water directly affects grapevine water balance and the accumulation of different metabolites in the berries. In conditions of moderate water stress, grapevines can maintain their physiological functions similar to watered plants. The aim of this trial was to investigate the relationship between water stress and phenolic accumulation in berries. Three-year-old Merlot grapevines grafted on SO₄ were grown in pots (80 L/pot), to compare different water regimes. Treatments were: (from véraison on): control (C; 80% available water); moderate stress (M; 30% available water); severe stress (S; 15% available water). The following physiological variables were measured: soil water content (TDR probes) and predawn leaf water potential. Berry samples were collected weekly from véraison on; berries were weighed and skins and seeds thereafter directly separated from the flesh. Spectrophotometric analyses of total phenolics, anthocyanins and hydroxycinnamyltartaric acids were performed. Localization of skin phenolics was carried out by electron microscopy. The M plants showed a behavior similar to C plants, but S plants revealed an unbalanced growth. Berry weight was reduced by water stress, but the concentration of phenolics increased. In conditions of water stress, all the classes of phenolics were less extractable from the berries. Electron microscopy revealed that phenolics were organized in little bodies in vacuoles, but it was impossible to find such structures in C-berry cells. From the physiological point of view, M plants demonstrated a good equilibrium in terms of growth, water balance and phenolic accumulation. Wine was made from these grapes in order to investigate phenolic extractability during fer-

mentation. S grapes accounted for a lower extraction of phenolics than M and C. The conclusion of this trial is that a moderate water stress improves plant physiological responses together with a good evolution and extractability of phenolics.

1540-1600

S05-O-34

NITROGEN AND WATER MANAGEMENT STRATEGIES FOR SUSTAINABLE VITICULTURE

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Optimizing vineyard inputs and fruit quality are important issues for sustainable viticulture. Regulated deficit irrigation (RDI) and partial rootzone drying (PRD) are irrigation strategies developed for this purpose. However, the effects of RDI and PRD on vine nutrition are not well understood. A field trial was set up in the Riverina, a major winegrape growing region of Australia. The trial consisted of three irrigation treatments (PRD, RDI and standard practice (STD)) factorialized with three nitrogen (N) applications (bloom to véraison, post harvest, and split application bloom to véraison/post harvest). The aim was to investigate interactions between water uptake and N nutrition in *Vitis vinifera* cv. Shiraz, and determine the effects on berry composition and vine physiology. PRD and RDI treatments increased Brix and decreased average berry weight, while PRD irrigation resulted in the highest berry anthocyanin concentration. Larger pruning weights in the STD irrigated vines were indicative of higher vegetative growth. Nitrogen application time had little effect on vine performance in the 2000-01 growing season, however there was a significant effect on juice amino acid content. Bloom-vevéraison N application resulted in a high arginine: proline ratio in the juice. The effect of post harvest N application on berry composition should be evident in the second season of the trial. Amino acids in the juice are a major component of the yeast assimilable nitrogen status required for fermentation. No significant interactions between irrigation strategy and N application time were apparent in vine productivity or berry composition for the 2000-01 growing season. Continuing data collection from this trial will provide further insight into optimizing water and nitrogen management for a sustainable viticulture industry.

1600-1620

S05-O-35

INFLUENCE OF WATER STRESS AND CROP YIELD ON PHYSIOLOGICAL BEHAVIOR AND PRODUCTIVITY ON TEMPRANILLO VARIETY UNDER SEMIARID CONDITIONS

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The influence of water stress and crop load on physiological behavior, yield, and fruit maturity of Tempranillo was studied over 4 years (1994-1997) in the Duero river region (Spain) under semi-arid conditions. Vines were spaced 3.0 m x 1.6 m (row x vine). The vines were trained on a vertical trellis with bilateral cordons and were spur pruned. In the non-irrigated treatments the only water available was rainfall. In the irrigated ones, a rate of 0.4 ET from June to September was applied. The crop load was controlled by cluster thinning at the beginning of véraison, by removal of 33% and 40% of the clusters per vine in 1994 and 1995-97, respectively. Physiological measurements were performed from véraison to harvest. The water stress reduced stomatal conductance, transpiration and net assimilation rate in the non-irrigated plants compared to the irrigated ones. The non-irrigated vines also accumulated less dry matter than the irrigated ones in the various aerial parts of the vine, and consequently their yields were lower. The sugar content in the fruit of the irrigated treatments was also higher than that of the non-irrigated plants until a certain yield level; thereafter, the effects of the treatments were mostly reversed. However, crop control did not impact vine physiology, although there was a tendency toward reduced stomatal conductance and transpiration in irrigated plants with high crop loads. There was also a tendency toward increased sugar content in the fruit from vines with lower yields.

Tuesday August 12

1620-1640
S05-0-35-A
TO BE ANNOUNCED

1640-1700
S05-0-35-B
TO BE ANNOUNCED

Thursday · August 15

1100-1140
S05-0-36
COLD HARDINESS OF VITIS: UNDERSTANDING AND ADAPTING TO SITE, CLIMATE, AND GENETIC LIMITATIONS

Tony K. Wolf

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Wine grapes are a brilliant example of man's reluctance to abide by climatic limitations of crop production. Although "cold hardy," the introduction of grapes into novel regions often raises the specters of cold injury, crop loss, and outright vine kill. Even "established" grape production regions witness periodic crop losses due to winter cold or frost. The risk of cold injury can be minimized by appropriate pairing of species and cultivars to vineyard site, and by the deliberate application of vine and vineyard practices that optimize vine cold hardiness. Research of the last 30+ years has provided considerable, but incomplete, guidance with respect to this goal. This presentation will briefly describe mechanisms of cold stress avoidance and tolerance in *Vitis* and it will review methods of stress and strain measurement. The discussion will also illustrate research that has significantly advanced our ability to profitably grow grapes on the cold margins of their genetic limitations.

1140-1200
S05-0-37
THE USE OF GROWTH REGULATORS TO IMPROVE BUD BREAK IN TROPICAL VINEYARDS

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The effectiveness of Ethrel and Dormex, alone or in combination, to improve bud break of grapevines under tropical conditions, was tested in a 5 year old commercial vineyard (*Vitis vinifera* L. cv Palieri) in Venezuela. The country's table grape industry is located at 9 degrees north latitude. Ethrel solutions of 3000, 4000 and 5000 ppm were applied one week before pruning and Dormex solutions of 3, 4 and 5% were applied 24 hours after pruning. The Ethrel treatments were applied using manual sprayers, while the Dormex treatments were applied by dipping the canes. Treatments including the use of both Ethrel and Dormex significantly improved both percentage bud break and yield.

1200-1220
S05-0-38
RELATION OF APPLIED CROP STRESS TO NEXT SEASON'S INFLORESCENCE DEVELOPMENT, SHOOT GROWTH CHARACTERISTICS, AND CANE STARCH RESERVES IN CONCORD GRAPEVINE

Martin C. Goffinet*

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Concord vines were adjusted to a range of crop stress relative to leaf area. Treatments were balance-pruning (BP) and three minimal-pruned (MP) treatments stressed either by defoliation in late July (MP-defol), unstressed by defruiting 30 days post bloom (MP-defrt), or untreated (MP-check). Winter buds and their emergent shoots were collected with their cane internodes through leaf fall for 3 years. Flower development and fruit-set were evaluated with regard to shoot length, leaf production, mature leaf number, and shoot leaf area. Canes were analyzed for carbohydrate (CHO) content. As crop stress increased by increasing shoot numbers

and by eliminating leaf area, the various shoot growth characteristics became more depressed. BP vines had greatest shoot growth, leaf production rate, leaf maturation rate, and greatest leaf area per shoot, while MP-defol vines had the least. Among MP treatments, MP-defrt vines consistently fared best. Florets in all treatments began to form in clusters at bud-swell; thereafter, florets rapidly and sequentially produced their floral organs. There was great floret abortion in clusters of all treatments well before bloom, but especially in the MP-defol treatment. By bloom, flower number in clusters of MP-defol vines was only half that of clusters in any other treatment, perhaps because much of floral development occurred before there were any mature leaves in MP-defol vines, and such leaves were smallest of all treatments. No matter the prior crop stress, starch reserves dissipated rapidly between bud break and bloom in canes, then increased post-bloom as new leaves began supplying a pool of new CHO. Overwintered starch reserves were least in the MP-defol treatment, most in BP, and intermediate in MP-defrt and MP-check treatments. This pattern also held for late-season restoration of reserve starch, so the extremely overcropped MP-defol vines ran the entire season on low reserves and later generated only low reserves for next season.

1220-1240
S05-0-39
INVESTIGATIONS ON LATERAL BUDS AND STARCH GRANULES OF DORMANT VITIS VINES BY SCANNING ELECTRON MICROSCOPY

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One-year old dormant canes of *Vitis* spp. Lacrosse (own-rooted) and Chambourcin (own-rooted and grafted to 3309 Couderc) in southeast Nebraska, USA, were sampled in January, February and March 2001. The lateral buds excised at the 5th and 6th nodes from the proximal end and the internode between the 5th and 6th nodes were dissected or sectioned for investigations of bud meristems or starch granules under scanning electron microscopy. The "dormant" lateral buds were actually growing as illustrated by the expanding bud size, increased number of primordia and number of potential shoots, all of which indicated that the vines were at ectodormancy. For all the buds observed, the primary and secondary buds in a lateral bud were readily observed in January and February; the tertiary bud, however, did not show up until buds were examined in March. Between January and March, the size of bud did not differ, although the number of primordia and the number of potential shoots were larger in March than those in January. There were no differences between own-rooted Lacrosse and Chambourcin in terms of primordia number, bud size, and potential shoot number, despite the fact that Lacrosse tended to have larger lateral buds. Rootstock effects were minor, but buds of grafted vines were relatively small and the size of the primary bud in January was smaller than that of the own-rooted vines. Observations of cross, tangential and longitudinal sections of dormant stems showed that starch granules were mainly located in ray parenchyma cells. For all the varieties and sampling dates investigated, no differences in distribution of starch granules were observed, which indicated that the growth of lateral buds in the dormant season may consume little reserves stored in the stems or only use those reserves stored in the bud itself.

1340-1440
S05-P-40
NO ABSTRACT AVAILABLE

1340-1440
S05-P-41
INHERITANCE OF SOME GRAPEVINE CHARACTERISTICS IN THE CROSSING COMBINATION OF ANTIGONA X SEYVE VILLARD 12-375

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The mode of inheritance of some important qualitative and quantitative grapevine characteristics has been investigated in 33 seedlings of the F1 generation from the crossing of Antigonax Seyve Villard 12-375. The mode of inheritance was assessed by t-test, and standard deviations (S) and coefficient of variations (V) were calculated. A monogenic segregation ratio of 1:1 was determined for berry skin color and cluster resistance to *Botrytis cinerea*. Negative heterosis was apparent for

yield. Low cluster weight and low berry weight appeared to be dominant characteristics. High must sugar content was also dominant. The smallest variability was measured for must sugar content ($V=10.76\%$), and the largest was for yield ($V=73.61\%$).

1340-1440

S05-P-42

BREEDING OF BLACK TABLE GRAPE CULTIVAR HEUKGOOSUL (*VITIS* SPP.) WITH LARGE BERRIES AND HIGH QUALITY

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Heukgoosul resulted from the cross between Golden Muscat and Pione by NHRI in 1988, was first selected in 1995. After regional adaptability tests under the name of Wonkyo RA-07 at seven sites during 1996-2000, it was finally selected in 2000 due to large berries and high quality. Although most cultivars have a berry shattering problem, Heukgoosul showed a low incidence of berry shattering, resulting in a good berry set compared to Kyoho. Budburst for Heukgoosul is 21 April, flowering 3 June, and fruit maturity 15 September (almost same as Kyoho at Suwon), and it is considered a midseason cultivar. The mean berry weight is 14.4 g, about 3 g bigger than Kyoho, and mean soluble solids are 18.4 (similar to Kyoho). The skin color is black with abundant bloom and the flesh firmness is soft and juicy. It is recommended that it be pruned to 6 to 12-node canes, 2 to 4 nodes shorter than Kyoho, because it is not as vigorous. Heukgoosul may be a substitute for Kyoho, due to its large sized berries with high quality and several characteristics for facilitating vineyard management such as good cold hardiness, good disease resistance and easy bearing habit.

1340-1440

S05-P-43

VARIABILITY IN THE AUTOCHTHONOUS VINE VARIETY KRATOSIJA

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Kratosija is an old Montenegrin grapevine variety of unknown origin. By the middle of the 19th century it dominated the Montenegrin variety list. Today it is uncommon in Montenegrin vineyards because of its heterogeneity and is mostly combined with the Vranac variety. To gain a better understanding of total variability of Kratosija and some of its biotypes, ampelographic description, agrobiological properties (phenology, yield and vegetative potential, etc.), pollen vitality and fruit set have been investigated. In this paper, the focus was functional ability of pollen and its germination, as well as degree of fruit set in self and open pollination conditions in 17 biotypes of Kratosija sampled from all vinegrowing districts of Montenegro and planted in the experimental vineyard of the Biotechnical Institute. There were differences in pollen germination in 18% of sucrose among several biotypes of Kratosija. In Velja Kratosija and Srednja Kratosija, germination was >40% while in most biotypes it was >30%. In Vranac, Vrana, Ljutica, Vrancic, Bikaca, and Rehuljaca, germination was <20%. Percent fruit set in self pollinated conditions in all biotypes of Kratosija was 37.1%, while under conditions of open pollination it was >53.5%. Significant annual fluctuations in fruit set were observed in both self pollinated and open pollinated conditions. Fruit set was higher in open pollination and was followed by pollination by a mixture of pollen from the experimental vineyard. A strong correlation existed between germination of pollen and fruit set in most of Kratosija biotypes.

1340-1440

S05-P-44

IN VITRO GROWTH OF GRAPES AS AFFECTED BY INTERACTION BETWEEN LIGHT AND CYTOKININS

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Shoot growth, number of shoots and fresh weight of *Vitis vinifera* L. Cabernet Sauvignon and *V. labruscana* Bailey Campbell Early explants under three light levels, -7, 0 and +7 DIF, provided by metal halide and fluorescent lamps, under 16h.d-1 photoperiod were studied. Basal Murishige and Skoog media were supplemented with 5 and 10 mM benzyladenine (BA), thidiazuron (TDZ), zeatin, 2-

indolepurine (2ip), and kinetin, respectively. In all media, 2.1 g·L⁻¹ gel and 3% sucrose were used and cultured for 4 weeks. Shoot growth was increased by control regardless of DIF in Cabernet Sauvignon and was suppressed by -7DIF. Effects of BA and TDZ were not affected by DIF. Growth was enhanced in ODIF with increasing cytokinin level. Kinetin at 10 mM was most effective for shoot growth with 87 mm among cytokinins used except for control. Zeatin and kinetin each at 5 mM increased shoot growth to respective 162 and 110 mm. In ODIF, a double increase of 162 mm was obtained by 5 mM zeatin. In the control, no further shoot proliferation was observed in Cabernet Sauvignon regardless of DIF. In 0 and +7DIF, four shoots were observed with 10 mM BA. Zeatin, 2ip, and kinetin resulted in poor shoot proliferation. BA at 10 mM resulted in profuse branching in all DIFs.

1340-1440

S05-P-45

CYTOGENETIC STUDY OF INTERSPECIFIC HYBRIDS BETWEEN *VITIS ROTUNDIFOLIA* AND *V. VINIFERA*

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Muscadine grape (*Vitis rotundifolia*) has a chromosome number $2n=40$. European grape (*V. vinifera*) has a chromosome number $2n=38$. With few exceptions, the chromosome numbers of hybrids between *V. rotundifolia* and *V. vinifera* are different from their parents and the hybrids are either completely sterile or highly sterile but with some fertility. To understand the variation of hybrid fertility, a study was conducted to investigate the chromosome number and pairings of the interspecific hybrids in mitosis and meiosis. Interspecific hybrids were obtained between cross of muscadine grape (female) x *V. vinifera* (male) and reciprocal crosses. Chromosome numbers of the hybrids used in this investigation were first confirmed by root tip cells in mitosis. Most of them had a chromosome number $2n=39$. Several morphological characteristics also clearly indicated that they are true *V. rotundifolia* x *V. vinifera* hybrids. Meiosis in pollen mother cells showed a certain degree of chromosome pairing (bivalent) with some monovalents. For those hybrids with $2n=39$, chromosome pairing ranged from 15 to 19. The result indicated that the low fertility of the hybrids is mainly due to the lack of chromosome pairings in meiosis.

1340-1440

S05-P-46

EFFECT OF DISBUDDING ON ROOTING OF DORMANT GRAPEVINE CUTTINGS

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The buds and leaves play the important role in rooting of cuttings physiologically. In dormant woody cuttings of grapevine, disbudding inhibits rooting and decreases auxin levels in their basal parts in which root formation occurs. It is suggested that the rooting of cuttings is controlled by auxin produced from buds. In this experiment, the effect of disbudding on the rooting of dormant cuttings was investigated using easy-to-root grapevine cultivar Takasumi. The disbudding did not adversely influence rooting of dormant cuttings. However, disbudding inhibited rooting after breaking dormancy. The rooting percentage in control and disbudded cuttings was high early in the dormant stage, and less to nil later in the dormant stage. The fluctuation pattern of diffusible auxin (IAA) after cutting was the same between control and disbudded cuttings. The disbudding didn't decrease auxin levels in the basal part of the cuttings either. These results indicate that the role of buds in rooting of dormant cuttings is different from that previously reported for dormant woody cuttings.

1340-1440

S05-P-47

CHARACTERISTICS OF A NEW WINE GRAPE HYBRIDIZED FROM RYUKYUGANEBU (*VITIS FICIFOLIA* VAR. GANEBU), THE JAPANESE WILD GRAPE

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Ryukyuganebu (*Vitis ficifolia* var. *ganebu*) is a wild grape native to the Ryukyu Islands in the southern region of Japan. The grape contains a high anthocyanin content in the berry skins, and berry skin color changes to a deep red-purple during the harvesting period, even under conditions of high night temperatures. This species was bred to produce a novel wine grape for use in similar regions, and the characteristics of this hybrid were investigated. The new wine grape was made by crossing Ryukyuganebu (female) with Muscat of Alexandria (*V. vinifera*) (male). The flower was hermaphroditic, skin color was a deep red-purple, and the lateral shoots had some clusters. The average weight of ripe berries was 0.7 g, about three times heavier than Ryukyuganebu and about 10 times lighter than Muscat of Alexandria. The soluble solid contents and acidity of the juice of that hybrid were comparable to Muscat of Alexandria. The seed of the grape was about halfway in size between those of the parent grapes. Ripe berries were fermented at 25 C by standard methods on September 21, 2000. Skins, pulps and seeds were removed from the fermenting liquid, and the must was allowed to continue fermenting. Fermentation of the must was completed on September 29. Wine made from that hybrid demonstrated higher absorbance values at 420 nm and 530 nm. The wine contained large amounts of polyphenolic compounds, as the color of the wine was very deep and the absorbance value at 280 nm was high. Coloration of the wine differed substantially from that of a standard Cabernet Sauvignon. Organoleptic analysis revealed a wine possessing a deep red-purple color, a green, sweet, and floral aroma. The wine had medium acidity and a light body in sharp contrast to the deep color. The results of this study indicate that this novel wine grape demonstrates a number of superior characteristics, and that wine made from this grape possesses a coloration and taste quite distinct from other more familiar wines.

1340-1440

S05-P-48

STUDIES ON SOME ROMANIAN BIOLOGICALLY-RESISTANT TABLE GRAPE AND WINEGRAPE VARIETIES

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Systematic studies were performed between 1996-1997 at Valea Calugareasca Viti-Vinicole Research Station on different Romanian biologically-resistant grapevine varieties. These included seedless table grapes (Andrevit and Valeria) and winegrapes (Admira, Brumariu, Purpuriu and Radames), all of which were bred in Romania. The ampelological traits of these varieties were studied. Due to a very good biological resistance, the Andrevit and the Admira varieties produced the highest yields (14.5 t/ha and 13 t/ha, respectively) and proved to be the most resistant to the main grapevine diseases. Volatile compounds from fresh musts obtained from the grapes were identified and quantified. Analysis showed 37 compounds in these musts, from different classes of organic derivatives: alcohols, aldehydes, ketones, acids, esters, aromatic hydrocarbons and terpenoids. Such compounds defined the aroma profile of each studied variety.

1340-1440

S05-P-49

RELATION OF ETHYLENE TO OVULE FORMATION OF GRAPE

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The grape ovary normally contains two carpels, originating from the four ovules. However, the number of carpels and ovules in some cultivars of grape are different. In this paper we report the relationship between the number of ovules in a carpel and ethylene. Grape cultivars used in this experiment were Kyoho and Takao. Ethephon at 25 and 50 ppm, 1-aminocyclopropane-1-carboxylic acid (ACC) at 1000 ppm and aminoethoxyvinylglycine (AVG) at 200 ppm were applied to clusters 3 weeks before full bloom. All solutions contained 0.1% approach BI as surfactant. The variation in the number of ovules in a carpel after application of ethephon, ACC and AVG were recorded 2 weeks after full bloom. In Kyoho, the percent number of ovules in a carpel of untreated ovaries >3 was 4.5%. The values for ethephon (both

concentrations) and ACC ranged from 0 to 1%. But 200 ppm AVG application significantly increased the number of ovules in a carpel by 11.5%. In Takao, the percent number of ovules in a carpel of untreated ovary >3 was 60.5%. The number of ovules following ethephon and ACC application decreased significantly by 30 to 41.5%, while there was no change with AVG application. These results show that differentiation of ovule in the carpel of grape may be controlled with ethylene synthesized in the ovary.

1340-1440

S05-P-50

IDENTIFICATION OF GRAPEVINE CULTIVARS IN KHORRAM ABAD (LORESTAN)

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Iran is considered an important grape growing country. More importantly, it is a region that lies within the center of origin of *Vitis vinifera*, from which a vast number of cultivars originate. Khorram Abad Lorestan, a main grape growing area, is rich in cultivars too, and therefore it was seemed necessary that they be studied and identified. The trend in modern agriculture today is to use a limited number of cultivars of any crop. Due to the modern trends toward monoculture, it was feared that minor cultivars that bear valuable genes for high yield, drought resistance, cold hardiness, salinity resistance, pest and disease resistance, etc., would gradually disappear. Thus, it was necessary to study, identify, and preserve cultivars in proper collections. Identification of grape cultivars, based on international descriptors, was conducted in 1993-95 in Kamalvand Khorram Abad Lorestan, an important grape growing area. During the study, 23 cultivars were identified, and more than 100 ampelographic characters were recorded for each. An identification key was prepared based upon the fruit and reproductive organ characteristics, and genotype relationships were developed using a cluster model.

1340-1440

S05-P-51

TISSUE CULTURE IMPROVES THE PROPAGATION OF NORTON GRAPEVINE (*VITIS AESTIVALIS*)

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Propagation of the *Vitis aestivalis* cultivar Norton through traditional woody cuttings has been difficult. Rooting of woody cuttings has been a major hindrance in propagating this cultivar and providing enough plants to meet grower needs. In vitro propagation offers another method of increasing plant material. Cultures were established from greenhouse-grown 3-year-old potted plants. Axillary buds (0.5 x 0.5 cm) were excised from actively growing shoots (30-50 cm in length). The excised axillary buds were then surface disinfected for 15 minutes in a 10% commercial bleach solution and washed three times for 5 minutes in sterile water. Cultures were initiated from individual axillary buds on Murishige and Skoog (MS) medium supplemented with 4 mM BA and 0.5 mg/L thiamine and solidified with 7.5 g/L Bacto-Agar. Ninety-three cultures were initiated with a contamination rate of 4.3% (4 of 93), and 61.3% (57 of 93) of the cultures becoming fully established and growing in vitro. Established cultures were transferred monthly to fresh medium. Explants were propagated placing two-node segments, with leaves removed, horizontally on the medium. Before transfer ex vitro, explants were cultured for one month on MS medium supplemented with 2 mM BA and 0.5 mg/L thiamine and solidified with 7.5 g/L Bacto-Agar. The explants were then transferred to peat pellets within sundae cups with lids for rooting and acclimation. Propagation of Norton through tissue culture appears to have potential to provide more plant material for growers in an expeditious manner.

1340-1440

S05-P-52

EFFECT OF MALE PARENT AND APPLICATION OF BORIC ACID ON EMBRYO RESCUE IN SOME SEEDLESS GRAPEVINE (*VITIS VINIFERA*) CULTIVARS

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Embryo rescue is one of the important methods in breeding seedless grape-

vine. Using this technique enables breeders to choose seedless cultivars as a female parent or even to cross two seedless cultivars to obtain a new seedless hybrid. This technique also results in incremental increase in the proportion of seedless progeny, which itself is one of the main goals in breeding table grapes. In this research, three seedless cultivars (Flame Seedless, Yaghooti and Askary) were selected as female parents and cultivars White Seedless, Dizmary (for Flame Seedless and Yaghooti) and Mehdikhani (for Askary) were chosen as male parents. On the first day of flower opening, all opened flowers were removed and the rest of the flowers in each inflorescence were emasculated. They were then hand pollinated with pollen of the aforementioned male parents 48 and 72 hours after emasculation. Berry samples were harvested 40 days after flower opening and their ovules were dissected out. Only large ovules were cultured in Nitsch and Nitsch medium containing 1 M GA₃, 10 M indoleacetic acid, 2 g/L active charcoal, 2% (w/v) sucrose and 0.8% (w/v) agar. Choice of male parent affected ovule blackening and ovule germination but had no effect on callus formation on ovule, ovule growth or ovule collapse. White Seedless increased the number of blackened ovules and reduced the number of germinated ovules, even compared to that of the selfed treatment. Effects of choice of seeded male parent varied among female parents. Spraying vines with boric acid at 3000ppm one week before flower opening had no effect on ovule germination.

1340-1440

S05-P-53

EVALUATION FOR PIERCE'S DISEASE AMONG MUSCADINE GRAPES

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Pierce's disease (PD), caused by gram-negative bacterium *Xylella fastidiosa* Wells et al. is the limiting factor to growing *Vitis vinifera* grapes in the southeast United States. The disease has become a major concern in California, due to the introduction of glassy-winged sharp shooter vector. The ultimate control of this disease may rely on the development of PD resistant grape cultivars. Grapes originating from the traditional PD area (southeast United States) are believed to be resistant to the disease. The Muscadine grape (*Vitis rotundifolia* Michx.) is considered to be one of the most resistant species. However, typical PD symptoms (marginal necrosis) are still observed on Muscadine grapes. In order to better understand the genetic variability of PD resistance among the Muscadine collections, evaluation was conducted at the experimental vineyard, Florida A&M Univ., Tallahassee. Three to 4 year-old vines of 51 Muscadine cultivars (six vines each), were evaluated for PD symptoms using a 0 to 5 scale, where 0 indicated no PD symptoms and 5 represented 75 to 100% of leaves with PD symptoms. Significant differences in severity were observed among the cultivars. Individual vines ranged in severity from no PD symptoms at all (0) up to 4 (51-75% of the leaves showing marginal necrosis). Average PD severity among the cultivars ranged from 0 to 2.7, but most of them fell below 1 (<10% of the leaves showing PD symptoms). The most severe PD symptoms were found in Carlos (mean = 2.7), which had PD ratings between 2 and 4 in individual vines. PD symptoms between 1-3 were observed for *V. rotundifolia* x *V. vinifera* hybrids. These results suggested that the PD resistance could be inherited from Muscadine grapes by the interspecific hybrids.

1340-1440

S05-P-54

RELATIONSHIPS AMONG QUALITATIVE AND QUANTITATIVE CHARACTERS IN 90 GRAPEVINE (*VITIS VINIFERA*) CULTIVARS

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In order to study genetic diversity, 90 cultivars of *Vitis vinifera* were evaluated for 24 characters. Vines were planted in a density of 2 m x 3 m (vine x row), trained to bilateral cordons and spur pruned. The experiment was conducted as a randomized complete block with three two-vine replications. Some characters related to bunch (weight, number, size, width, length and position), berry (number, size, width, length, weight and density), seed (length, weight, number/berry), composition (soluble solids, titratable acidity, time of maturity) and vine yield were evaluated. The phenotypic coefficients of variation and variance analyses were highly significant ($P < 1\%$), indicating a huge variation among cultivars. The results of phenotypic correlation, multiple regression and path analysis showed that bunch number, bunch weight, berry number and berry weight characters had

the greatest effect on yield. Principal component analysis and factor analysis showed that seven factors with eigen values >1 contributed 81% and 80% of total variation in the data, respectively. Cluster analysis was also run on the basis of full character and seed and berry characters using the Ward method, and in both clusters, cultivars grouped into four subclusters.

1340-1440

S05-P-55

FERTILITY AND PRODUCTIVITY CHARACTERIZATION OF THE BEARING UNITS OF THE VERDEJO VARIETY TO IMPROVE PRUNING STRATEGIES

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The pruning system is one of the most important limiting factors for low productivity varieties such as Verdejo. The most planted grapevine varieties in Spain are well adapted to spur-pruned systems, but in some cases, as with the white variety Verdejo, the grapegrowers use cane-pruned systems to compensate for the low fertility of its basal buds. Cane-pruned systems have some management difficulties, especially poor adaptability to pruning mechanization. To introduce more practical pruning systems, as the Royat cordon, it was necessary to know the differences in the productivity of the buds relative to their location, such as a spur or a cane. Moreover, it is important to investigate the influence of apical dominance on buds at the same node position but on different lengths of bearing units. Comparing units with two, six and 10 buds it was observed that shoot and bud productivity increased with increasing length of bearing unit. However, the percentage of decrease of fertility was lower in spurs than in canes due to the higher budburst of the basal buds on the spurs. In general, the first and the second buds on spurs showed a higher level of budburst, flowers per cluster, fruit set and berries per cluster than the first and the second buds on cane. It is necessary to take into account the fruitfulness of buds relative to their location to devise a pruning strategy for a specific level of yield.

1440-1500

S05-O-56

ROOTSTOCK INFLUENCE ON SCION VIGOR, HARDINESS, YIELD, AND FRUIT COMPOSITION OF ST. PEPIN GRAPE

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Rootstocks for grapevines may contribute to scion vigor and winter hardiness, and may affect crop yield and composition, although the extent of rootstock effects on vigor, yield and fruit composition may not be pronounced enough for commercial producers to invest in grafted vines unless phylloxera or nematode resistance is conferred by the rootstock. In a 7-year study of winegrape cultivar St. Pepin, grafted onto four rootstocks (ES15-53, MN 1065, MN Rip 64, C3309) and its own roots, winter hardiness, vine vigor, yield, and fruit composition were measured. Weight of cane prunings, yield, berry weight, cane periderm development, survival of buds in controlled freezing conditions, survival of vines over 6 years, and fruit pH, titratable acidity and degrees Brix were measured. There were few differences in vine growth, yield and fruit composition among the rootstock-scion combinations, and differences were not consistent over multiple years. The most marked difference among the rootstock-scion combinations was the death over 6 years of 25% of the vines on Couderc 3309 and 15% of the vines on ES 15-53, apparently due to winter injury; on the other hand, only 8% of vines on MN Rip 64 and MN 1065 died, and all vines grafted to own root survived.

1500-1520

S05-O-57

EFFECT OF HOT-WATER ON REST TERMINATION AND RESISTANCE OF *VITIS VINIFERA* BUDS

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Laboratory experiments were conducted to determine the effect of hot water

temperature and exposure time on rest termination and bud survival of three grape cultivars (Safidebidaneh, Ghiziluzum, and Rishbaba). A completely randomized design within a factorial treatment arrangement with three replications was used. In November, dormant cuttings were submerged in hot water at six different constant temperatures [0 (as control), 40, 45, 50, 55, and 60 °C] in combination with three exposure periods (10, 20, and 30 min.). Budbreak was recorded over a period of 5 weeks. The interaction of temperature and exposure time was significant with respect to bud break. The rate of bud break initially increased with increasing temperatures and/or the exposure until it reached an optimum value, and thereafter decreased. Most buds broke for all three cultivars during the first 2 weeks following a regime of 55 °C for a period of 20 minutes. At 60 °C, an inhibiting effect on bud break was observed, and all buds were injured. In control cuttings, no bud break occurred throughout the experiment period as a result of endodormancy.

1520–1540

S05–0–58

THE INFLUENCE OF PLANT GROWTH REGULATORS INCLUDED IN THE FORCING SOLUTION ON BUD BREAK OF DORMANT GRAPE-VINES (*VITIS* SPP.)

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Dormant vines of *Vitis* sp. cv. Lacrosse were sampled in January, February and March 2001. Effects of basic forcing solution (2% sucrose and 200 ppm 8-hydroxyquinoline citrate) and exogenous additions of hormones abscisic acid (ABA), gibberellic acid (GA3) and benzyladenine (BA) on bud break of dormant vines were investigated. The basic forcing solution tended to shorten the days to bud break, although not significantly different from the pure water control. The days to bud break differed substantially across the 3 months, whereby January > February > March, indicating that buds were more ready to break close to spring. The addition of plant growth regulators caused different responses during the 3 months. GA3 actually prolonged the days needed for bud break, which was not expected. For all treatments containing GA3, the best concentrations were 10 ppm and 75 ppm in January, 50 ppm in February and 10 ppm in March. BA (0, 10, 25 and 50 ppm) had no effect, although 10 ppm BA tended toward shortest time to bud break. ABA prolonged the days needed for bud break; 50 ppm and 100 ppm delayed bud break by 10 and 14 days in January; 2 and 4 days in February; and 5 and 8 days in March, respectively. A linear regression was found for ABA treatments between concentration and days to bud break.

1540–1600

S05–0–59

RELATIONSHIP BETWEEN THE SUGAR CONCENTRATION OF GRAPE BUDS AND THEIR FREEZE TOLERANCE

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The subject of this study was the investigation of the quantitative and qualitative changes of some mono- and disaccharides in the grape buds after freezing treatments. Grape buds were treated for 4 hours at temperatures of 0, -10, -15, -20 and -25 °C in special freezing chambers. Identification and quantification of the various sugars was carried out with HPLC. Experiments were done in three different stages of dormancy through the winter for 4 consecutive years. Freeze resistance levels of the cultivars used in the experiments extremely differed. Fructose, glucose, sucrose and raffinose were identified in the buds, with sucrose concentrations being the highest. In the deep phase of dormancy, sucrose concentration in the buds increased as the temperature was lowered. Maximum sucrose concentrations were attained at temperatures between -15.8 °C to -20.8 °C (depending on the genotype), below which the concentrations decreased. By the end of the dormancy, significant sucrose concentration changes could not be induced by freezing treatments. Freezing treatments caused no changes in the concentrations of glucose and fructose. There was, however, a general decrease in the total sugar concentration during the winter, with the sucrose concentration decreasing to the greatest degree. Concentrations of glucose and fructose were nearly the same in the three experiments carried out in one year. These results suggest that the level of freeze tolerance is related primarily to the monosaccharide:sucrose ratio more so than to the concentration of individual

sugars. Relationship between freeze tolerance and this ratio was also apparent for a group of hybrids with different levels of winter hardiness.

1600–1620

S05–0–60

FRUITSET AND POLLINATION REQUIREMENTS IN WINEGRAPES

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Good pollination and fertilization are essential in most fruit crops and these are managed in tree fruits by inter-planting with suitable pollinizer varieties and by bringing in beehives etc. The planting of pollinizers for winegrapes has never been done and it is conventional to believe that it is unnecessary. However, the literature is surprisingly mute on the question of the importance of pollen source in winegrapes, so this belief is not well founded. Until relatively recently, vineyards have been small and have contained mixtures of varieties, enabling free cross-pollination and making the provision of specific pollinizers unnecessary. With modern large plantings of single varieties and clones it is timely to re-examine the conventional thinking. In New Zealand, winegrape yields have ranged between 7 and 14 tonnes/ha in the last decade. The variability is largely attributable to variable fruit set. It was reasonable to ask, therefore, whether some of this variability might be attributable to pollination/fertilization problems. Trials were run in Marlborough and in Hawkes Bay, New Zealand, to identify possible influences of pollen source on the components of yield. It was hypothesized that improved pollination would result in more ovules developing into seeds. This would result in the setting of more seeds per berry and thus, presumably, increased fruit set and bigger berries. Together these would result in increased bunch weight and overall yield. Trends in bunch weight across interfaces between large blocks of different varieties were examined. In 25% of cases, there was a tendency for bunch weight to increase (or to decrease) near the interface. Bunches from one transect (Cabernet Sauvignon vs Merlot) were chosen for a more detailed analysis of berry number, seed number and seed weight. Results suggested that pollen source could influence fruit set and berry quality in winegrapes.

1620–1640

S05–0–60–A

TO BE ANNOUNCED

1640–1700

S05–0–60–B

TO BE ANNOUNCED

Friday · August 16

0800–0900

S05–P–61

THE EFFECTS OF BUD NUMBER AND CANE LENGTH ON FERTILITY CAPACITY, YIELD, AND FRUIT COMPOSITION OF SULTANA

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Grapevine node number and cane length affect different factors such as leaf area, growth rate, percent bud break, percent fruiting shoots, fertility coefficient, number and weight of clusters, and fruit quality. In this research, effects of two node numbers (48 and 72 nodes per vine), three cane lengths (4, 6 or 8 nodes) and their interactions were examined on Sultana grapevines using a randomized complete block design with a factorized treatment arrangement with three single-vine replicates. Increasing cane length and node number per cane increased cluster number, number of fruiting shoots and fertility coefficient and had no undesirable effects on cluster weight. There was more fruit potential in the apical buds of the canes than in nodes one to four first buds (which were mostly vegetative) and long pruning in Sultana appears to be necessary.

0800-0900**S05-P-62****THE BEST HARVESTING DATE OF SULTANA GRAPES FOR PRODUCING FAVORABLE RAISINS**

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Exports of Iranian raisins have declined in recent years. Part of this may be due to quality issues. There are many factors affecting raisin quality, including harvest date, which may impact yield and other factors. This investigation was carried out to determine the best time of Sultana grape harvesting in Qazvin, for obtaining a raisin uniform in color and size, with suitable taste, and with high yields. Harvest dates at 10-day intervals were used in a randomized complete block experiment with four, four-vine treatment replicates in a Takestan region vineyard. For each harvest date, pre-dried total soluble solids (TSS), cluster length, cluster weight, berry weight and volume, and yield were measured; after drying, variables such as color, weight, marketing value and amount of recoverable raisin were measured. Late harvests were the most suitable, with about 23% TSS, a weight of 0.36 g per raisin, and the best drying ratio (3.5).

0800-0900**S05-P-63****PERFORMANCE OF SOME DOMESTIC AND IMPORTED GRAPE VARIETIES UNDER IRRIGATED CONDITIONS IN GAZIANTEP**

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Performances of some domestic and imported grape varieties, including newly-bred varieties, were recorded in Gaziantep (Turkey). Twenty-one varieties were planted in 1987 at a 3 m x 2 m row x vine spacing, trained to a Guyot system and drip irrigated. Highest yields were observed in Kizlartahtasi, Italia, Hatunparmagi and Horozkarasi, with 51.5, 50.3, 34.7 and 29.6 t/ha, respectively. Lowest yields were observed for Uslu and Muscat Hamburg with 4.9 and 6.4 t/ha, respectively. Although Tahannebi has heretofore been known as the earliest variety for Southeast Anatolia, some newly-bred varieties such as Uslu, Trakya Ilkeren, Yalova Incisi and Baris mature even earlier.

0800-0900**S05-P-64****RED EARLY SEASON TABLE GRAPE CULTIVAR HONGISUL (*VITIS* SPP.)**

Kyo-Sun Park, Heung-Soo Seo, Hae-KeunYun*, Sang-Bouk Jeong, Wee-Cheon Kim

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Hongisul resulted from a cross between Campbell Early (*Vitis labruscana* Bailey) and Himrod (*Vitis* spp.) by NHRI in 1981. It was first selected in 1995, tested in the region as Wonkyo RA-06 at seven sites from 1996-2000, and named in 2000. Hongisul has high quality with high soluble solids (TSS), low titratable acidity, attractive red skin color, abundant bloom, and no skin cracking. Hongisul has a mean budburst on 20 April, flowering on 3 June, and fruit maturity 31 August, 5 days earlier than Campbell Early at Suwon, and it is considered an early season cultivar. The mean berry weight is 5.9 g, similar to Campbell Early, and has a mean TSS of 16.3%, about 1-2% TSS higher than Campbell Early. The flesh texture is medium and juicy. Hongisul has good cold hardness, disease resistance and fruiting habit. It is recommended that Hongisul be planted as replacement for Campbell Early, the leading table grape in Korea.

0800-0900**S05-P-65****EFFECT OF SOLUBLE SOLIDS CONTENT ON PRODUCTION AND QUALITY OF RAISINS**

Mohammad Ali Nejatian*, K. Arzani

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There are many factors that determine quality and yield of raisins. Total

soluble solids (%TSS) of fresh grapes, among other factors, plays a significant role in determining quality, yield and production efficiency of raisins. This investigation was carried out to study the effects of %TSS on raisin quality and production efficiency, and to determine the acceptable minimum %TSS for producing the highest quality raisins. The experiment was performed in a Takestan Sultana vineyard. In order to obtain different %TSS levels, fruit was harvested at 10-day intervals. A randomized complete block with four, four-vine treatment replicates was used. On each harvest date, 10-12 kg samples were taken, and %TSS and berry weight and volume were measured; after drying, color, marketing value, berry weight and drying ratio were measured. Samples for evaluation were classified into 10 groups according to original %TSS, in which each group contained four samples with similar original %TSS. Higher %TSS was associated with increases in quality, color, berry weight, and raisin production efficiency. The recommended minimum is 21 %TSS for producing highest quality raisins.

0800-0900**S05-P-66****VITICULTURE AND ENOLOGY IN THE DOMINICAN REPUBLIC: SITUATION, LIMITATIONS AND POSSIBILITIES**J. Pablo Morales-Payan*¹, Melba Morales-Payan²¹Univ. of Florida Horticultural Sciences Dept. 1246 Fifield Hall, PO Box 110690, Gainesville FL 32611; ²Bodegas Unidas, Santo Domingo, Dominican Republic

Commercial grapes were introduced to the Dominican Republic in the early 1500s. Ever since, grapes of Spanish origin have been produced on the island. In spite of excellent soils and climate for grape production in the western part of the country, grapes have not become a major crop. The area under grape production is about 1000 ha nationwide. In the past, social and historical factors have limited the expansion of viticulture and enology in the island. Currently, the major constraint for this industry is probably the lack of appropriate genetic resources for winemaking and even for fresh market grapes. The industry relies mostly on natural variants of the original Spanish introductions, in which a wide genetic variability has been observed. The expansion of the wine market in the country in the last 20 years has led to interest in screening local varieties and introduction of foreign cultivars to promote wine production. Pest and disease pressure have not been a major limitation in the last 500 years, but practices related to plant nutrition, irrigation, plant growth regulators, and post harvest management could be improved. A sustained development program, including components such as cultivar evaluation, crop management, and wine production, could result in a prosperous viticulture/enology industry in the soils and climate of the western part of the Dominican Republic.

0800-0900**S05-P-67****USING BACTERIAL CONCENTRATES OF SPONTANEOUS MICROFLORA FOR INDUCING MALOLACTIC FERMENTATION IN MURFATLAR RED WINES**

G. Marin, G. Beleniuc*

Research Station for Viticulture and Oenology Murfatlar, Basarabi, 8764, Constanta, Romania

The degradation of malic acid in wines by malolactic fermentation (MLF) is well known worldwide. Ribereau-Gayon emphasized that MLF is indispensable for wines of high quality in Bourgogne. The degradation of the malic acid has three effects: reduced acidity, stabilization from a bacterial point of view, and a modification of the organoleptic properties. Investigations concerning malolactic fermentation have been carried out in Romania since the late 1970s. The objective of this research was to investigate the initiation and control of MLF by using bacterial concentrates of spontaneous microflora. The results were the following: Number of lactic bacteria of the bacterial concentrate were in the order of 1.0 to 1.4 x 10⁶ cells/mL. The quantity of inoculum used for initiation of MLF was 4 to 5 x 10⁴ cells/mL. After the introduction of the ML bacteria in wine, they passed through a period of adaptation, depending of the moment of introduction. The bacterial concentrate of spontaneous microflora is advantageous, because it can be preserved in a refrigerator without the bacterial cells losing their viability. The introduction of ML bacteria into wine should be made after alcoholic fermentation. We recommend the use of bacterial concentrates of spontaneous microflora to produce a controlled MLF and in a relatively short time.

0800-0900**S05-P-68****INFLUENCE OF FERMENTATION CONDITIONS AND YEAST SPECIES ON THE GLYCEROL CONCENTRATION OF WINES**

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Among the secondary products of alcoholic fermentation, glycerol arguably has the greatest importance due to its favorable influence on organoleptic properties of wines. Its synthesis depends upon many factors. This study was conducted under laboratory conditions, using selected yeast strains from the Murfatlar Research Station yeast collection, belonging to the *Saccharomyces ellipsoideus*, *S. bayanus* and *S. italicus* species. The fermentation medium was Pinot gris must which was inoculated with 1.5 to 1.7×10^7 cells/mL. The objective was to enumerate the importance of several factors that determine wine glycerol concentration (e.g. must sugar and glycerol, concentration of inoculum, fermentation temperature, and yeast species). The glycerol produced was determined by a volumetric method with potassium iodate. The results were: 1. Depending on of the grapevine variety and sugar content of the must, glycerol concentration of the grapes varies between 1.70 to 3.02 g/L; 2. The inoculation rate had an influence on the glycerol concentration of wines; 3. The most glycerol was formed in the first 2 to 3 days of fermentation; in this period 80 to 90 g/L of the initial sugar decreased and about 2/3 of the glycerol was formed; 4. The most glycerol was obtained at fermentation temperatures of 20 °C and 25 °C; 5. A fermentation temperature >30 °C leads to a decrease of glycerol formation; 6. Yeast species and the sugar content had the greatest contribution to glycerol formation. Among the strains tested, SE-2, belonging to *Saccharomyces* species was notable. This strain produced the highest glycerol concentration in wines (7.80 to 9.20 g/L) and did not produce foam during fermentation.

0800-0900**S05-P-69****BERRY SET AND FRUIT QUALITY OF INDUCED-SEEDLESS KYOHO GRAPES AS INFLUENCED BY GROWTH REGULATORS**

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Seedless berry production in Kyoho grapes by gibberellin (GA) application is an effective quality improvement practice. However, seedlessness is often unstable year to year due to poor berry set and growth. This experiment was focused upon determining the optimal stage of cluster development for the first GA treatment and the effect of thidiazuron (TDZ) on the berry set and fruit quality. Clusters were dipped in 12.5 mg·L⁻¹ GA or 12.5 mg·L⁻¹ GA + 2.5 mg·L⁻¹ TDZ, respectively at the stages of 0, 10, 80, 100% flowering. The second treatment was made with 25 mg·L⁻¹ GA + 5 mg·L⁻¹ TDZ regardless of the first treatments. Clusters treated with GA alone at 0% flowering stage were low in both berry set and seedlessness. The GA treatment at 10% flowering increased berry set and seedlessness but berry growth was no better than 0% flowering. The addition of TDZ resulted in an increase of berry set even at 0% flowering but berry size was not affected. To determine the effect of TDZ concentration within combined treatments of GA and TDZ on the first treatment, clusters were dipped in 12.5 mg·L⁻¹ GA + one of four TDZ concentrations (0, 1.25, 2.5, 5.0 mg·L⁻¹) at 80% flowering. The addition of TDZ increased berry set. Compact clusters were produced due to a decrease in petiole elongation. Our results indicated that the optimal time of the first GA treatment was at 80% flowering, and that the addition of TDZ at 1.25 mg·L⁻¹ enhanced berry set.

0800-0900**S05-P-70****INDUCTION OF COMPACT CLUSTERS WITH LARGE SEEDLESS BERRIES IN THE GRAPE CULTIVAR FUJIMINORI BY THE USE OF STREPTOMYCIN, GIBBERELLINS, AND CPPU**

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The grape cultivar Fujiminori is a new tetraploid table grape registered in 1985. It is seeded, and has a larger berry than the most popular grape in Japan, Kyoho. Japanese consumers preferences for table grapes are complete seedlessness, large berries (>20 g) and compact clusters of 450 to 500g. This study was conducted to investigate the use of streptomycin (SM), gibberellins (GA), and 1-(2-chloro-4-pyridyl)-3-phenylurea (CPPU) to promote seedlessness and enhance berry size in

Fujiminori. Manual berry thinning to produce compact clusters of 450 to 500 g instead of 2 to 4 kg was also tested. Dipping flower clusters with 200 ppm SM at 14 days prior to full bloom induced complete seedlessness; however, the sizes of these parthenocarpic fruits were less than the seeded ones. Spraying 2.5 ppm GA and thinning to 22 to 24 berries per cluster at full bloom increased the weight of the seedless berries. The fruiting portion was restricted to the 3.5 to 4.0 cm section at the top of the cluster. At 10 to 12 days after full bloom, 25 or 50 ppm GA and 10 ppm CPPU were applied by dipping the cluster to further promote berry size. Cluster quality was not influenced much by the increased berry size induced by these treatments.

0800-0900**S05-P-71****DETERMINATION OF OCHRATOXIN A IN TURKISH SULTANAS**Uygun Aksoy*¹, Rengin Eltem¹, Ahmet Altındisli¹, Kamer Betül Meyvacı¹, Mustafa Ates²¹Ege Univ. Fac. of Agriculture Dept. of Horticulture 35100 Izmir, Turkey; ²Research and Development Center TARIS Ege Univ. Campus 35100 Izmir, Turkey

Research on Turkish Sultana grapes was initiated in 1998 after reports of ochratoxin A (OTA) incidence in importing countries. After a survey of OTA results from laboratories, a sampling plan was developed for the whole region (Gediz Basin in the western part of Turkey), whereby 62 vineyards were selected and analyzed in 1998, 21 in 1999 and 5 in 2000 and 2001. The mycoflora of the samples (soil, fruits at veraison, fresh grapes and dried raisins) were determined. Information on site and cultural practices (soil cultivation, irrigation, pruning, pest management), slope, soil type, temp., RH, type of drying yard, type of trellis, final market, number of damaged berries and GA application was collected. The potential ochratoxigenic fungi were isolated and identified. The *Aspergillus* and *Penicillium* spp. were cultured on two media: Czapek solution agar and malt extract agar, and incubated at 25°C for 7-10 days. For dried fruits, two media were tested: DG18 and Rose Bengal Chloramphenicol Agar. *Aspergillus* spp. with black spores were identified as major OTA producers. As a result of 3 years of study it was concluded that the frequency of OTA in fresh and dried fruits were similar but the level of contamination increased due to the loss of water. OTA formation started at the time of ripening (not a storage problem) and was not specific to a region but widely dispersed. More than one fungus species was effective (*A. ochraceous*, *A. petrakii*, *A. carbonarius*, *A. foetidus* var. *pallidus*, *P. viridicatum*). Higher incidence in damaged berries was noticeable but these were not always correlated. Yearly variations in terms of total mould count, ochratoxigenic fungi and OTA incidence were significant. Soil can be accepted as the main source of OTA, and damaging the berry is the major factor triggering ochratoxin formation.

0900-0940**S05-O-72****MANAGING VINE SIZE—A KEY TO ACHIEVING BALANCE IN THE VINEYARD**

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A balanced vineyard is one, that consistently achieves the production goals of the manager. Because grapes are the world's most important fruit crop and are grown for very different markets and in very diverse environments, specific production goals vary greatly. However, regardless of the production goal, vines respond to the same factors that determine growth processes. Understanding how these factors interact to affect vine growth and development is the task of the vineyard manager. Focusing on management's impact on vine size in relation to long term productivity and fruit composition simplifies the decision process. This presentation will review the interactive, long term (20 years) impact of management variables on vine size in relation to crop size and fruit composition. Examples will be given the way intensive or extensive management approaches can be used to achieve different production goals.

0940-1000**S05-O-73****INFLUENCE OF ROOTSTOCKS ON THE PERFORMANCE OF PINOT NOIR CLONE 10/5 IN A COOL CLIMATE**Tom Crossen*¹, Glen L. Creaşy², Gilbert Wells², Gwyn Williams³, Michael C. Trought⁴

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There is a general lack of understanding of the influence of various rootstocks on the performance of vines in cool climates. Apart from resistance to phylloxera, rootstocks are known to influence fruit composition, vine vigor and nutrient accumulation. There is believed to be a marked interaction between rootstock and site, although this is poorly understood and not widely reported. The viticultural soils of the Waipara district have been well mapped and the climate well documented. Understanding the effect of soil type and climate on rootstock performance is essential for future successful viticulture in the area. To assist in the choice of rootstock suitability, a replicated trial was established in Waipara, North Canterbury, New Zealand in spring 1997. Pinot noir clone 10/5 was grafted to one of eight rootstocks and managed as part of a commercial vineyard block. The rootstocks under investigation were 101-14, 3309 Couderc, Teleki 5C, Schwarzmann, Riparia Gloire, Fercal, 99 Richter and 420A. Initial pruning data collected in August 1998 provided data that can be used in cool climates to estimate the influence of initial vine health on subsequent growth. The first significant crop from the trial was produced in the 2000-2001 season. During April 2001, a 10-bunch sample (two per vine) was harvested from each replicate, juiced and total soluble solids, pH and titratable acidity determined.

1000-1020

S05-O-74

BIOSYNTHESIS OF ANTHOCYANINS IN SHIRAZ GRAPE BERRIES

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Grape berries contain relatively large amounts of anthocyanins and other polyphenols, which contribute greatly to their appearance. In this research the contribution of leaves to anthocyanin biosynthesis post-veraison via phloem unloading into Shiraz berries was investigated, to elucidate how much anthocyanin could be synthesized from seed tannins. The grape clusters were isolated by two girdlings to disconnect the bunch from the phloem of the shoot. The girdlings were done at 2 weeks before veraison up to a week after veraison in one-week intervals. Sugar (total soluble solids), anthocyanins, polyphenols and glycosyl-glucose (GG) concentrations were measured in the berries. The berry weight, mean seed weight and other variables also were measured. Girdling both before veraison and at veraison significantly affected anthocyanins, total phenolics, glycosides, berry weight and total soluble solids (sugar). Changes in total soluble solids closely accompanied changes in color and anthocyanin levels of the skin. Little if any anthocyanin accumulated in the early girdled bunches, but in the bunches girdled at veraison, color accumulation started and then stopped soon thereafter. This experiment showed that phloem sap has greatest contribution in supplying metabolites in the ripening berries.

1020-1040

S05-O-74-A

TO BE ANNOUNCED

1400-1420

S05-O-75

DOES UV RADIATION AFFECT WINEGRAPE COMPOSITION?

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Ultraviolet (UV) radiation is known to influence plant growth, development, morphology and physiology, but its effects on the fruit composition of grapevines are unknown. Potted Cabernet Sauvignon and Chardonnay grapevines were grown in Australia under either ambient or reduced (2% of ambient) UV during two consecutive seasons. UV reduction was achieved using diacetate films suspended above the plants. In addition, two nitrogen treatments were applied at flowering in the first season and two water regimes were imposed from fruit set to leaf fall in the second season. Ambient UV reduced early-season shoot growth but stimulated lateral shoot growth later in the season and enhanced root growth.

UV had no clear effect on leaf chlorophyll and gas exchange but reduced leaf water content and water-use efficiency, and increased carotenoid and flavonoid concentrations. Flower calyptra contained high concentrations of flavonols, but this UV protection was temporarily lost during cap fall (anthesis), making the flowers vulnerable to UV. The combination of ambient UV and low nitrogen stress resulted in reduced fruit set. Nevertheless, UV failed to influence yield and fruit sugar content. Ambient UV increased the flavonol content in ripening post-veraison berries, but had no effect on anthocyanins, hydroxycinnamic acids and stilbenes such as resveratrol. The impact of UV on fruit amino acids varied with individual compounds, but was non-significant for the predominant amino acids proline and arginine. Hence, of the fruit composition variables examined, only flavonols were notably affected by UV radiation. Compared with Chardonnay, vegetative growth of Cabernet Sauvignon was more tolerant, but reproductive growth was more sensitive to UV. In general, low nitrogen stress enhanced the UV effect, but low water stress reduced it.

1420-1440

S05-O-76

INFLUENCE OF ORGANIC AND CONVENTIONAL MANAGEMENT ON YIELD AND COMPOSITION OF GRIGNOLINO GRAPES

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Organic management frequently involves a reduction of nitrogen input and it is claimed to increase grape quality. Excess nitrogen application reduces anthocyanidin concentration, thus decreasing the antioxidative potential of grapes and wines. In order to compare the effects of organic and conventional fertility management on vine performance and antioxidant properties of wine grapes, a field trial was carried out in 20-year-old Grignolino vineyards located in the Piedmont region (North-Western Italy). The vineyards were managed either conventionally (40 kg/ha N) or under one of three different organic fertilization regimes: i) organic fertilizer (300 kg/ha; 11% organic N); ii) a mixture of mycorrhizae and plant growth promoting bacteria (100 kg/ha; 0.034% organic N); iii) a combination of both (i) and (ii) (250+100 kg/ha). The following variables were measured: yield, vine growth, leaf N content, flavonoid concentration, and antioxidant potential of berry skin extracts. The latter was estimated by measuring the decrease of the EPR signal associated with the semiquinone radical (generated by enzymatic oxidation of catechol) induced by the presence of the berry skin extract. Yields in the organic vineyards were lower than under conventional management. No differences were observed in grape yield and growth amongst the organic fertilization treatments. The overall flavonoid concentration was higher in organic grapes, resulting in a higher protection from oxidation. Moreover, the three organic treatments enhanced the flavonoids in the berry skin extracts, and as a consequence, increased its antioxidant potential. Treatment (iii) was the richest in polyphenols, while the antioxidant potential was highest in the extracts from treatment (ii). In conclusion, environmental factors seem to prevail over genotype in determining the polyphenol concentration and antioxidant properties of grapes.

1440-1500

S05-O-77

THE EFFECTS OF IN-THE-ROW SPACING ON GROWTH, YIELD AND FRUIT COMPOSITION OF VERDICCHIO VINES TRAINED TO SPUR-PRUNED AND FREE CORDON

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The effects of in-row vine spacing (0.7 m; 1.0 m; 1.2 m and 1.6 m) on the performance of Verdicchio trained to spur pruned (SPC) and free cordon (FC) systems were tested in an hillside experimental vineyard established in 1993 in the Marche (Central Italy) with N:S oriented rows spaced 2.5 m apart. The respective planting densities for the four vine spacings were 2500, 3333, 4166 and 5882 vines per hectare. The SPC contained a fruiting wire at 0.85 m above the ground and two pairs of movable wires to support upward shoot growth, while the FC had a single wire at 1.8 m above the ground. Grapevines were unilateral cordon trained and spur pruned both systems. The vines were pruned to two to three nodes during the winter following the first growing season and the trunk was formed from the best shoot that developed during the second season of growth.

At the beginning of the third year, 82% of SPC vines had extended canes beyond the space allotted to them, but only 62% of FC vines had canes long enough to complete their framework. In the third year, SPC vines attained the highest yields and soluble solids concentration. The vine spacing hardly affected the rate of vine establishment and trellis fill, yield and berry composition in the third year. By the fourth year, all SPC and FC vines had filled the trellis. FC vines attained the highest yields, but no differences between training systems were observed for juice composition. Again, vine spacing did not affect yield or juice composition.

1500–1520

S05–0–78

IMPACT OF MINIMAL PRUNING ON VIGNOLES GRAPEVINES

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Vignoles is a grapevine cultivar commonly used to produce wines in Eastern and Southern USA viticulture districts. Common problems associated with culture of Vignoles are susceptibility to the summer bunch rot complex or *Botrytis* bunch rot due to the cultivar having small, compact clusters. Minimal pruning is a production system that has no dormant season pruning and almost complete mechanization of vineyard operations. This system has been demonstrated in California and Australia to reduce labor requirements, maintain or improve yield, and reduce the incidence of certain fungal diseases including bunch rot. The objective of this experiment was to evaluate the impact of minimal pruning on yield, fruit composition, and incidence of summer bunch rot complex of Vignoles grapevines. In this study, minimal pruning was evaluated against hand pruning in a randomized complete block experimental design during the 1999–2001 seasons. Minimal pruning produced higher yield in 2 of 3 years studied. Clusters per vine were higher for minimal pruned vines while hand-pruned, control vines displayed greater cluster weight. Percentage rot was similar between treatments for 2 of 3 years studied. These results indicate that minimal pruning can be used for commercial Vignoles production. However, minimal pruning did not consistently reduce the incidence of summer bunch rot complex.

1520–1540

S05–0–79

LIGHT COMPONENTS CONTRIBUTING TO ACCUMULATION OF ANTHOCYANINS IN GROS COLMAN GRAPE BERRIES

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Light conditions are an important factor affecting coloration and accumulation of anthocyanins in table and wine grapes. Usually, the light environment is evaluated by the total intensity, mainly in the visible wavelength region.

Besides the quantity, light quality seems to be important for berry coloration as was shown in other fruits. In this study, the contribution of light with different wavelengths to the accumulation of anthocyanins was investigated by using berry sections under various light conditions. At veraison, the equatorial sections were dissected from softened green berries of Gros Colman and were placed in plastic Petri dishes containing 0.4 M sucrose. These sections were thereafter subjected to several light treatments for 72 hr, after which anthocyanin concentration was measured. Under white and UV fluorescent light, anthocyanins started to accumulate 48 hr after initiating illumination. After 72 hr, anthocyanin concentration was markedly increased by white light. Under UV lighting, a considerable amount of anthocyanins also accumulated relative to dark conditions. As white and UV light intensities increased, anthocyanins gradually increased, but this promoting effect of light on the accumulation of anthocyanin was saturated at 40 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for white and 0.4 W/m^2 for UV. Using light emitting diodes emitting specific wavelengths ranging from the blue to far red regions, the action spectrum for anthocyanin accumulation was determined. Among the visible light wavelengths, blue light largely enhanced anthocyanin accumulation, as did red and far red wavelengths, while the green to yellow range was less effective. These results suggested that the relatively short wavelength band ranging from blue to UV was important for the accumulation of anthocyanins in Gros Colman grapes.

1540–1600

S05–0–80

CHANGES IN GRAPE MATURITY INDUCED BY SPRAYING ETHANOL

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Spraying low concentrations of ethanol onto grape berries during the ripening period induced various changes in the berry composition of Cabernet Sauvignon grapes. Three different ethanol concentrations were studied: 2.5, 5 and 10% in water. Controls were sprayed with water alone. Three different times of spraying were also tested: 8, 10 and 13 weeks post-flowering. Grape composition variables measured over the ripening period (from time of spraying to harvest) included Brix and titratable acidity (TA) of the berry juice, and absorbance at 520 nm of methanolic extracts of berry skins. One of the observed changes was a lower TA in samples sprayed with 5% ethanol compared to controls, without significant changes in the yield per vine. This could have practical implications for cool climate viticulture. Ethanol concentration and color intensity were also measured in wines produced from the experimental grape samples. There may be a potential link between ethanol application and ethylene production, together with a proposed role for ethylene in the grape ripening process. These hypotheses are supported by results from previous experiments examining effects of ethephon and ethanol application at similar times in grape ripening.