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Oregon Tree Fruit and Nut Research Abstracts 1982-1983

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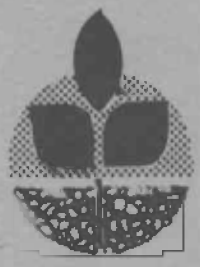

Agricultural Experiment Station
Oregon State University, Corvallis

OREGON TREE FRUIT AND NUT RESEARCH ABSTRACTS
1982-1983

(Supplement to Oregon Agricultural Experiment Station
Special Reports 341, 355, 417, 461, 512, 598, and 665)

Compiled by Porter B. Lombard
Professor of Horticulture

INTRODUCTION

The index which follows is complete through 1983 and includes all the abstracts from Special Reports 341, 355, 417, 461, 512, 598, and 665 plus items 732 through 791 of the attached supplement. For best use of this abstract supplement, it should be attached to Special Reports 341, 355, 417, 461, 512, 598, and 665.

As was done with the earlier compilations, full reprints of papers 732 through 791 will be filed under the same numbers in the libraries of the Branch Stations at Hood River and Medford and in the Horticulture Department library at Corvallis. This is done for the convenience of Extension workers and others who might need to study the full report from which the abstract was taken.

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PAPER ABSTRACTS

732. Stebbins, Robert L. and H. R. Cameron. 1983. Performance of 3 Sweet Cherry, Prunus avium L. Cultivars on 5 Clonal Rootstocks. Fruit Varieties Journal 21-23.--Prunus avium cvs Napoleon, Bada and Corum were grafted on limbs of the following rootstock clones: F 12/1, MxM 2, MxM 60, MxM 97, and OCR 2. After 7 years, ignoring the effect of rootstock, Bada trees were half as large as Napoleon and Corum trees were slightly larger than Napoleon. Trees on MxM 2 rootstock were not different in size from trees on F 12/1. Trees grafted on MxM 60 were 60% as large, and on MxM 97, 34% as large. Trees on OCR 2 were precocious but were removed infection with prune dwarf virus. All MxM trunks suckered more than F 12/1. Rootstock had little or no effect on fruit size, soluble solids, removal force or yield, except MxM 97 which were weak and low-yielding.

733. Geddeda, Yosef I., J. M. Trappe, and R. L. Stebbins. 1984. Effects of Vesicular-Arbuscular Mycorrhizae and Phosphorus on Apple Seedlings. J. Amer. Soc. Hort. Sci. 109(1):24-27.--Mycorrhizal fungal inoculation of seedlings of apple (Malus domestica Borkh.) substituted for P application in soils deficient in P. Of 3 mycorrhizal species, Gigaspora margarita Becker & Hall was the least effective in promoting plant growth, Glomus fasciculatum (Thaxter sensu Gerdemann) Gerd. & Trappe was the most effective, and Glomus mosseae (Nicol. & Gerd.) Gerd. & Trappe was intermediate. Combining the 3 species was no more effective than G. fasciculatum alone. VA mycorrhizae increased leaf P concentration in apple leaves from 0.04% to 0.19% on Parkdale soil which had an exchangeable P content of 13 ppm.

734. Geddeda, Yosef I., J. M. Trappe, and R. L. Stebbins. 1983. Vesicular-Arbuscular, Mycorrhizal Fungi Associated with Apples Grown in Oregon. HortScience 18(6):929-930.--Vesicular-arbuscular (VA) fungi from roots of apple (Malus domestica Borkh.) and soil from apple orchards in Oregon included Gigaspora margarita Becker & Hall, Glomus fasciculatum (Thaxter sensu Gerdemann) Gerd. & Trappe, and Glomus mosseae (Nicol. & Gerd.) Gerd. & Trappe. G. mosseae was the most competitive species in colonizing apple roots in certain Oregon orchards, based on spore identification. Other mycorrhizal fungi were identified in soils in which apples were growing.

735. Sugar, David and Porter B. Lombard. 1981. Pear Scab Influenced by Sprinkler Irrigation Above the Tree or at Ground Level. Plant Disease 65(12):980.--The incidence of pear scab, caused by Venturia pirina, was monitored in a high-density orchard of Bartlett and Anjou pear trees. Replicated plots were irrigated by sprinklers above the trees or at ground level. Infection nearly doubled between 1 June and harvest in late August in plots irrigated from sprinklers above the trees but did not increase significantly in plots irrigated at ground level.

736. Hoy, Marjorie A., P. H. Westigard, and S. C. Hoyt. 1983. Release and Evaluation of a Laboratory-Selected, Pyrethroid-Resistant Strain of the Predaceous Mite Metaseiulus occidentalis (Acari:Phytoseiidae) in Southern Oregon Pear Orchards and a Washington Apple Orchard. J. Econ. Entomol. 76(2):383-388.--A laboratory-selected strain of the spider mite predator Metaseiulus occidentalis (Nesbitt) was released into two southern Oregon pear orchards and a Washington apple orchard in June 1980. The permethrin and organophosphorus insecticide (OP)-resistant predators became established in all three orchards, overwintered, and survived repeated permethrin applications during 1980 and 1981. By summer 1981, the predators had spread into adjacent trees in release areas in both states. Foliage damage was substantially reduced compared with trees lacking the permethrin-OP-resistant predators in Oregon in 1981. In Washington in 1980, spider mite populations were significantly lower and M. occidentalis populations significantly higher on release trees than on control trees. In 1981, the frequency and rates of permethrin applications caused high mortality of the resistant M. occidentalis and high spider mite densities developed on all sampled trees. Permethrin resistance levels remained high in the orchard populations after two field seasons, despite the polygenic nature of this resistance. Future releases should be considered, especially where releases can be made into each tree and selective acaricides can be used to manage spider mite-predator densities until a more stable relationship occurs.

737. Liss, W. J., L. J. Gut, P. H. Westigard, and C. E. Warren. 1982. A Perspective for Understanding Arthropod Community Organization and Development in Pear. Acta Horticulturae 124:85-100.--A conceptual and theoretical framework for understanding the organization and development of complex arthropod communities is presented and interpreted in pear. Several levels of organization or relatively discrete community subsystems lying between species populations and the community as a whole can be recognized. We have termed these subcommunities, systems of populations, and guilds. Arthropod community structure and organization can be understood as conforming or being concordant with the structure and organization of the community habitat. A tentative view of arthropod community habitat structure and organization in pear is suggested. Arthropod community development is taken to be change in community structure and organization through time. Community development can be understood as being determined by the developmental pattern of the community habitat (change in habitat structure and organization through time) and the potential capacity of the community. Community potential capacity for development is interpreted as residing in the species pool of potential arthropod colonists. The species pool can be conceptualized as a system of arthropod communities each developing on a particular community habitat. This theoretical framework suggests that management of arthropod community development entails management of species pool structure and organization and community habitat developmental pattern.

738. Hoyt, S. C., P. H. Westigard, and R. E. Rice. 1983. Development of Pheromone Trapping Techniques for Male San Jose Scale (Homoptera: Diaspididae). Environ. Entomol. 12(2):371-375.--The effects of pheromone trap design and trap placement on collections of male San

Jose scale, Quadraspidiotus perniciosus (Comstock), were studied over a 3-year period in California, Oregon, and Washington. Open (tent) trap designs were more efficient that closed traps, with small tent traps as good as larger tent traps. Trap placement in the north or east tree quadrants consistently produced the highest collections of male scale, but these catches are probably influenced by local meteorological conditions at the time of male flight. Collections of male scale increased as trap height increased into the upper tree canopy. Comparisons of the three pheromone isomers showed isomer SJS-3 generally to be more attractive than either SJS-1 or SJS-2. Pheromone dispenser load rates of 100 to 1,000 µg of SJS-2 showed no significant reduction in scale collections with 300- to 1,000-µg rates, compared with fresh 300-µg loads after 8 weeks of field exposure. Fresh, 300-µg loads were significantly better than all dispensers aged 16 to 19 weeks in the field.

739. Gut, L. J., C. Jochumus, P. H. Westigard, and W. J. Liss. 1982. Variation in Pear Psylla (Psylla Pyricola Foerster) Densities in Southern Oregon Orchards and its Implications. Acta Horticulturae 124:101-111.--Inter-orchard differences in pear psylla densities are reported for untreated pear orchards in southern Oregon. Psylla densities in all of the untreated orchards were highest early in the season (April). The number of pear psylla nymphs per leaf at this time ranged from 0.35 to 3.45. Seasonal trajectories of psylla levels followed two general patterns: 1) psylla nymphal densities decreased rapidly, reached levels close to zero by June or July, and showed no resurgence through the rest of the summer, or 2) psylla nymphal densities decreased more gradually and more importantly, rebounded to damaging levels later in the summer. Predator exclusion experiments, seasonal patterns of psylla predator levels, and psylla densities in insecticide treated orchards indicated that predator activity contributed to the regulation of pear psylla. Regulation as a result of predator activity was related to the nature of the predator complex and the timing of their presence in the orchard. The occurrence of an early season complex of soldier beetles and green and brown lacewings or snakeflies was an especially important component leading to control. Biological control of pear psylla is discussed in terms of the management of inter- and intra-orchard habitats to promote these important aspects of predator activity. Other factors which may contribute to the regulation of pear psylla numbers below damaging levels, such as orchard location in terms of potential for colonization by its predators or manipulation of habitat suitability, are also discussed.

740. Fuchigami, L. H., C. J. Weiser, K. Kobayashi, R. Timmis, and L. V. Gusta. 1982. A degree growth stage (°GS) model and cold acclimation in temperate woody plants. Plant Cold Hardiness and Freezing Stress Mechanisms and Crop Implications. Ed. by P. H. Li and A. Sakai. Academic Press. New York. 93-116.--A degree growth stage (°GS) model to quantitate growth stage units of temperate plants is described. The model is designed to numerically describe and predict the annual growth cycle and cold hardiness of vegetative buds of temperate woody species. The model is divided into 360°GS units, through the following major ontogenetic stages of development (point events): spring bud break (0, 360°GS), maturity induction point

(90°GS), vegetative maturity (180°GS), maximum rest (MR), and end of rest (315°GS). The paper discusses the methods used to determine these major point events and the other numerical GS units. Computer models, based on the °GS model, have been successfully developed to determine vegetative maturity, maximum rest, end of rest, spring bud break, and cold acclimation/deacclimation of red-osier dogwood, Cornus sericea L.

741. Lombard, P. B., P. H. Westigard, J. G. Strang, R. B. Allen, and D.N. Joy. 1982. Effect of Nitrogen and Daminozide on Shoot Growth for Pear Psylla Suppression and on 'Bartlett' Pear Performance. HortScience 17(4):668-669.--Three consecutive annual nitrogen applications on trees of 'Bartlett' pear (Pyrus communis L.) at 120 kg/ha increased leaf N, shoot growth, number of expanded shoot leaves, crop density, fruit size, and yield compared to no N. N application without butanedioic acid mono- (2,2-dimethylhydrazide) (daminozide) increased late bloom and fruit russet associated with pear psylla honeydew. Daminozide at 2 g/liter sprayed twice annually for 3 years, 30 and 50 days after bloom with or without N application, reduced minal growth, number of expanded shoot leaves, late bloom, fruit size, density of psylla nymphs, (Psylla pyricola Foerster) and fruit russet from psylla honeydew. The effects of N and daminozide on tree growth, fruit size, and yield, as well as on psylla density, varied from year to year. Daminozide can reduce shoot growth of pear and subsequently reduce psylla densities and resultant damage but with some reduction in fruit size.

742. Miller, Jeffrey C. and Jan E. Cronhardt. 1982. Life History and Seasonal Development of the Western Winter Moth Operophtera occidentalis (Lepidoptera: Geometridae), in Western Oregon. Can. Ent. 114:629-636.--In western Oregon, Operophtera occidentalis (Hulst) has four larval instars, is univoltine, and polyphagous. Adult activity peaked in early December, eggs overwintered, larvae rere present from March to June, and pupae from May to December. Temperature thresholds for egg and larval development were estimated to be 2°C. Few species of natural enemies were observed and rates of parasitism averaged 2%.

743. Miller, Jeffrey C. 1982. Sampling for Larvae of Operophtera occidentalis (Lepidoptera: Geometridae) on Cherry. J. Econ. Entomol. 75:1021-1024.--Larvae of a winter moth, Operophtera occidentalis (Hulst), occurred on sweet cherry in western Oregon from late March to early June. A cluster of buds-leaves was determined to be the most discrete and suitable sample unit for estimating larval density. Variance-mean ratios indicated that the dispersion of larvae within trees was random but larval dispersion between trees was clumped. Apical bud-leaf clusters contained nearly twice as many larvae as subapical clusters. The number of bud-leaf clusters and trees to be sampled was determined as a dependent variable based on a proportion of the mean larval density.

744. AliNiazee, M. T. 1983. Carbaryl Resistance in the Filbert Aphid (Homoptera: Aphididae). J. Econ. Entomol. 76:1002-1004.--Development of resistance to carbaryl in field populations of the filbert aphid, Myzocallis coryli (Goetze), is reported here for the first

time. The log dosage mortality curves of three aphid populations with different carbaryl exposure history suggest that resistance was acquired in a relatively short time (4 to 5 years, perhaps sooner), but the degree of resistance increased as insecticide use was prolonged. Aphid populations exposed to carbaryl for 5 years (about nine sprays) required 17 to 22 times more chemicals to obtain mortality similar to that of the susceptible strain. The population exposed to carbaryl for 20 years (45 sprays) required about 78 to 145 times more chemical than did the susceptible strain. Resistant aphids attempted to avoid insecticide residues more vigorously than did the susceptible aphids, suggesting that insecticide avoidance behavior might be involved in this resistance mechanism.

745. Croft, B. A. and M. T. AliNiazee. 1983. Differential Resistance to Insecticides in Typhlodromus arboreus Chant and Associate Phytoseiid Mites of Apple in the Willamette Valley, Oregon. Environ. Entomol. 12:1420-1423.--Strains of Typhlodromus arboreus Chant resistant to azinphosmethyl and carbaryl occur in intensively sprayed apple orchards of the Willamette Valley, Oregon. These mites are equally resistant to these compounds as are resistant strains of the congeneric species, Typhlodromus occidentalis Nesbitt, but they are more susceptible to diazinon and phosalone than T. occidentalis. Resistant T. arboreus are more resistant to azinphosmethyl and carbaryl, but are almost equally susceptible to diazinon and phosalone as another associated species, Amblyseius andersoni Chant. The implications of these resistance features to colonization by these mites of intensively, moderately, and seldomly sprayed apple orchards in the Willamette Valley are discussed.

746. Mumtaz, M. M. and M. T. AliNiazee. 1983. The Oviposition-Deterring Pheromone in the Western Cherry Fruit Fly, Rhagoletis indifferens Curran (Dipt., Tephritidae). 1. Biological properties. Z. ang. Ent. 96:83-93.--Laboratory and field studies indicate that the oviposition deterring pheromone (ODP) of the western cherry fruit fly, Rhagoletis indifferens Curran, is a biologically active compounds(s). The pheromone which is deposited on the ovipositing surface by female flies soon after egg laying is capable of deterring repeated oviposition in the same fruit for an extended length of time. Even under confined laboratory conditions, the flies were able to perceive this compound(s) and discriminate between previously oviposited and unoviposited fruit. The ODP of R. indifferens is highly soluble in distilled water and methanol and can be washed off the substrate (real cherries or artifical wax cherries) by using any one of these 2 solvents. It retains its effectiveness in both water and methanol washings, and also after heating in boiling water for 2 minutes and refrigeration at 3°C for 17 days. It is effective at concentrations as low as only half the amount deposited during a single oviposition. Described here is a simple bioassay technique which was used to establish ODP(s) in R. indifferens. The oviposition-behavior in this species, and the role of this peromone in egg dispersal and control of the species are discussed.

747. Mumtaz, M. M. and M. T. AliNiazee. 1983. The Oviposition-Deterring Pheromone in Rhagoletis indifferens Curran (Diptera, Tephritidae). 2. Chemical Characterization and Partial Purification. Z. ang. Ent.

96:93-99.--The oviposition-deterring pheromone (ODP) of the western cherry fruit fly, Rhagoletis indifferens Curran is an extremely stable compound(s) both under acidic and basic conditions. The extraction experiments showed that the pheromonal compound(s) was unextractable into any of the organic solvents including chloroform, hexane, ethyl acetate and ether, both in acidic and basic conditions, and that the activity remained in the aqueous phase. Dialysis experiments suggest that the molecular weight of the ODP component(s) is less than 12,000. A generalized scheme for partial purification and accumulation of the pheromone is described.

748. AliNiazee, M. T. 1983. Influence of Environmental Factors on Daily Flight Activity of the Filbertworm, Melissopus latiferreanus (Lepidoptera, Olethreutidae). Ecol. Entomol. 8:241-248.--1. Flight of Melissopus latiferreanus (Walsingham), the filbertworm, was influenced by a number of environmental factors including temperature, wind, and rainfall. 2. Few M. latiferreanus moths were trapped in light or suction traps or found in sweep nets samples when air temperatures were above 31°C or below 15°C. Moth captures were optimum when prevailing temperature was between 21 and 26°C. 3. Typically, moth flights began at about sunset and continued throughout the night with a peak of 22.00 hours, about an hour after sunset. 4. Very few moths were trapped under showery and gusty conditions when wind velocity was over 16 km h^{-1}. 5. More moths were captured in light traps during dark nights than on full moon nights. The pattern of captures indicated that females flew earlier than males.

749. AliNiazee, M. T. 1983. Monitoring the Filbertworm, Melissopus latiferreanus (Lepidoptera: Olethreutidae), with Sex Attractant Traps: Effect of Trap Design and Placement on Moth Catches. Environ. Entomol. 12:141-146.--Different trap designs and trap placement methods were tested for catching males of the filbertworm, Melissopus latiferreanus Walshingham, in sex attractant traps. Zoecon's Pherocon IC trap captured more moths than any other trap tested. Although there was no significant difference between the efficacy of this trap and the three other traps (Pherocon II, 3.8-liter ice cream cartons without lids and with half lids). Significantly more moths were caught in traps hung at a height of 4 to 4.8 m above ground level (tree height 4.7 m) than at lower heights. Over 80% of the moths were captured by traps placed in the top of the tree canopy or just above it. Although more moths were caught in the traps placed in south and west quadrants of the trees than north and east, statistically significant ($P \leq 0.05$) differences were not noticed. Relatively few moths were caught in traps placed at distances of 10, 20, 30, and 50 m away from the orchard. A standardized methodology is suggested for monitoring the filbertworm with sex attractant traps.

750. AliNiazee, M. T. 1983. Pest Status of Filbert (Hazelnut) Insects: A 10-Year Study. Can. Ent. 115:1155-1162.--Two blocks (one .36, other .48 ha) of filbert (hazelnut), Corylus avellana L., trees were left unsprayed for 10 years and the pest status of different species determined by periodic field examination and damage counts. The omission of all pesticides resulted in excessive build-up of the filbertworm, Melissopus latiferreanus (Wals.) (Lepidoptera: Olethreutidae) populations resulting in an average of over 20% nut

damage. Filbert leafroller, Archips rosanus (L.) (Lepidoptera: Tortricidae), and filbert aphid, Myzocallis coryli (Goeze) (Hemiptera: Aphididae), populations declined and no apparent economic damage was caused by these two pests. No damage was observed from other recorded arthropod pests. An economic analysis of standard filbert pest control programs in the Willamette Valley of Oregon indicated that during the study years, the total insecticide spray expenditures in commercial orchards ranged from 6.5% to 18.3% of the yearly returns in U.S. dollars/ha. Damage in unsprayed study orchards during this 10-year period suggests that the sprays applied for the control of aphid and leafroller yielded no return, while the sprays applied for control of the filbertworm returned an average of $3.80 for every dollar spent.

751. Stark, S. B. and M. T. AliNiazee. 1982. Evaluation of Modifications to a Basic Thermal Summation Model for Predicting the Time of Emergence of the Adult Western Cherry Fruit Fly, Rhagoletis indifferens Curran (Dipt., Tephritidae). Z. ang. Ent. 94:401-407.--Two thermal summation models were constructed for predicting the mean time of emergence of the adult western cherry fruit fly, Rhagoletis indifferens. The first model uses the basic day-degree computation, where the daily thermal sum is computed as the difference between the average of the maximum and minimum daily temperatures and the lower developmental threshold temperature. The second model more accurately estimates the area under the daily temperature curve, bounded by both upper and lower developmental thresholds. Although the simple thermal summation model provides a less accurate estimation of the area under the temperature curve, it was found to be nearly as accurate in predicting the mean time of emergence of adult R. indifferens.

752. Stark, Steven B. and M. T. AliNiazee. 1982. Model of Postdiapause Development in the Western Cherry Fruit Fly. Environ. Entomol. 11:471-474.--Postdiapause developmental rates of the western cherry fruit fly, Rhagoletis indifferens Curran, were determined for various constant-temperature treatments and used in the construction of a simulation model. The temperature-dependent postdiapause developmental rate relationship was modeled by fitting an exponential curve to developmental rates at low to intermediate temperatures and a quadratic curve to developmental rates at higher temperatures. This developmental rate function was incorporated into the model which predicts the postdiapause development of soil-dwelling pupae of R. indifferens as influenced by soil temperatures. From these predictions, the times of the first, 10 and 25% emergence levels, and the mean time of emergence, are predicted for the entire soil column from which emergence occurs. The model was found to be highly accurate for predicting the times of these levels of adult fly emergence.

753. Vankirk, J. R. and M. T. AliNiazee. 1982. Diapause Development in the Western Cherry Fruit Fly, Rhagoletis indifferens Curran (Diptera, Tephritidae). Z. ang. Ent. 93:440-445.--Diapause development rate of the western cherry fruit fly, Rhagoletis indifferens Curran pupae as measured by the percentage of adult eclosion, the pattern and synchronization of eclosion, and the mean time to eclosion after exposure to different cold temperatures, was optimum at 3°C. Both

6° and 9°C environments were adequate for completion of diapause and there appeared to be only slight difference between the rate of diapause development at all these three temperatures. Chilling pupae at temperatures below 3°C or above 9°C reduced the diapause development rates, although some eclosion was noticed at -3, 0, and 17°C. However, the eclosion levels and synchrony were poor, indicating lowered diapause development at these temperatures. A very small (3%) proportion of the test population completed diapause development without exposure to cold temperatures indicating the presence of non-diapausing genotypes.

754. Chen, P. M., W. M. Mellenthin, and D. M. Borgic. 1983. Changes in Ripening Behavior of 'd'Anjou' Pears (Pyrus communis L.) After Cold Storage. Scientia Hortic. 21:137-146.--'d'Anjou' pear fruit, harvested at optimum maturity with flesh firmness of 6.8 kg, were stored at -1.1°C. Fruit were ripened at 20°C for 15 days following storage for 1-8 months. Dessert qualities were evaluated organoleptically on Day 10 of each ripening period. Changes in fruit firmness, extractable juice, titratable acids, soluble solids, respiration, ethylene production and internal ethylene were determined daily during each ripening period. Fruit firmness declined continually from 6.8 kg at harvest to 4.5 kg after 8 months of storage. Fruit stored for 2-8 months softened with a similar pattern during a 15-day ripening period at 20°C, while fruit stored for 1 month softened at a slower rate during ripening to 3.2 kg, with a coarse and dry texture after 15 days at 20°C. Fruit stored for 2-4 months ripened with the desirable buttery and juicy texture, while those stored for more than 5 months ripened with a coarse or mealy and dry texture. The buttery and juicy texture was highly correlated with a lower extractable juice, which could be used for quantitative determination of storage life based on ripened fruit quality. Changes in titratable acids and soluble solids during each ripening period were not associated with changes in dessert qualities of the ripened pears. Rates of respiration, ethylene production and internal ethylene during ripening at 20°C varied with duration of storage, but were not associated with changes in dessert qualities of the ripened fruit.

755. Chen, P. M., W. M. Mellenthin, and S. B. Kelly. 1983. Fruit Quality of 'Bosc' Pears (Pyrus communis L.) Stored in Air or One Percent Oxygen as Influenced by Maturity. Scientia Hortic. 21:45-52.--'Bosc' pears were harvested on 9, 16, 23, 30 September and 7 October 1981. The starting date of commercial harvest was 16 September. Fruits were stored in either air or 1% O_2 (with 0.03% CO_2) at -1.1°C until 1 March 1982. Irrespective of different harvest dates and storage conditions, ripened fruit with a buttery and juicy texture were always associated with a distinct reduction in extractable juice (EJ) of 9 ml/100 g F.W. and an increase in soluble solids (SS) of 1% compared with unripened fruit. The flesh texture of fruit stored in air for more than 90 days became coarse and dry upon ripening; its EJ was only 2-3 ml/100 g F.W. less than unripened fruit, and its SS remained unchanged. Fruit stored in 1% O_2 (with 0.03% CO_2) until 1 March 1982 was capable of ripening with moderately buttery and juicy texture irrespective of different harvest dates. However, fruit harvested between 30 September and 7 October suffered substantial

core injury after prolonged storage in 1% O_2 (with 0.03% CO_2) atmosphere.

756. Facteau, T. J., K. E. Rowe, and W. M. Mellenthin. 1982. Fluoride Investigations at the Mid-Columbia Experiment Station: 1961-1979. Oregon Agric. Expt. Sta. Tech. Bull. 143.--Fruit set of sweet cherries was reduced if sprays containing fluoride (sodium or ammonium fluoride or hydrofluoric acid) were applied during anthesis. Sprays applied at other times during the fruit-growing season caused fruit and leaf symptoms, depending on the concentration of fluoride, but no reductions in fruit set. Symptoms of fluoride toxicity were blackening, shriveling, and "dimpling"; increased firmness of the stylar end of the fruit and marginal necrosis; interveinal chlorosis, cupping, reduced leaf size, and a loss of leaf tip. Similar responses were found, both with respect to fruit set and symptom expression, when sweet cherry limbs were enclosed in mylar cages and fumigated with gaseous hydrogen fluoride for varying periods of time at varying air fluoride concentrations. Fruit set reduction was linearly related to increasing dose of fluoride (expressed as hours exposure times concentration of fluoride in $\mu g/m^3$). Germination of pollen and growth of pollen tubes were found to be inhibited by fluoride. Growth of fruit and vegetative tissues was influenced only at the higher levels of gaseous fluoride tested (4-6 $\mu g/m^3$) and generally after whole season treatment.

757. Chen, P. M., D. G. Richardson, and W. M. Mellenthin. 1982. Differences in Biochemical Composition between 'Beurre d'Anjou' and 'Bosc' Pears during Fruit Development and Storage. J. Amer. Soc. Hort. Sci. 107(5):807-812.--A comparative study in 1979 and 1980 between 'Anjou', a long-keeping winter pear and 'Bosc'. a shorter keeping winter pear (both Pyrus communis L.) revealed that ethanol-insoluble matter, titratable acids, soluble solids, proteins, and free amino acids in fruit of both cultivars during fruit development, maturation, and storage period fluctuated from season to season and were not associated with their difference in postharvest life. Malic acid was the major fraction of organic acids in both cultivars, and it declined at a faster rate in 'Bosc' than in 'Anjou' during storage at -1.1°C. The amounts of citric, oxaloacetic, and fumaric acids were higher in 'Bosc' than in 'Anjou' and were maintained at constant levels throughout the storage period. Internal ethylene in both cultivars early in fruit development was about 0.3 ppm and decreased rapidly to below 0.07 ppm during late fruit development and harvest period. For 2 seasons, 'Bosc' was capable of ripening after less than 20 days of chilling at -1.1°C when its internal ethylene increased to 0.2 ppm, while 'Anjou' required at least 50 days of chilling to develop the ripening capacity coincident with an internal ethylene above 2.0 ppm. Internal ethylene accumulated in 'Bosc' about 8 times faster than in 'Anjou' during the first 60 days of storage at -1.1° and reached an equilibrium at 40 ppm for 'Bosc' and only 5 ppm for 'Anjou' during the remaining storage period. After any corresponding period of cold storage, both ethylene and CO productions of 'Bosc' at ripening temperature of 20° were higher than those of 'Anjou', and 'Bosc' also required fewer days to reach the climacteric peaks than did 'Anjou'.

758. Facteau, T. J. and N. E. Chestnut. 1983. Effect of Pyrene and Fluoranthene on Pollen Tube Growth in Apricot and Sweet Cherry. HortScience 18(5):717-718.--In vivo pollen tube growth of apricot (Prunus armeniaca L. cv. Tilton) was unaffected by air concentrations of pyrene or fluoranthene ranging from 0 to 4.7 $\mu g/m^3$ and times of exposure from 16 to 48 hours. At similar exposure times and pollutant concentrations, pollen tube growth of 'Van' sweet cherry (Prunus avium L.) in 'Napoleon' styles was reduced as in dose (hours exposure times pollutant concentration in $\mu g/m^3$) of pyrene increased.

759. Facteau, T. J. 1982. Levels of Pectic Substances and Calcium in Gibberellic Acid-treated Sweet Cherry Fruit. J. Amer. Soc. Hort. Sci. 107(1):148-151.--Foliar applications of gibberellic acid (GA_3) to mature 'Lambert' sweet cherry trees (Prunus avium L.) about 21 days before harvest increased fruit weight (fresh and dry), soluble solids (SS), alcohol-insoluble substances (AIS) (both concentration and per fruit), ash weight, and fruit firmness at harvest. Application of GA_3 did not affect concentrations of ethylene diamine-tetaacetic acid (EDTA) or pectinase-soluble pectins and fruit Ca. GA_3-treated fruit had lower concentrations of water-soluble pectins and reduced surface pitting. Fruits sampled at 3-7 day intervals (starting about 21 days before harvest) from control and GA_3-treated trees showed that as an average response over a 29-day sampling period GA_3 increased fruit weight, firmness, AIS concentration, AIS per fruit, pectinase-soluble pectins, and decreased water-soluble pectins. Neither total, residual, or soluble fruit Ca was affected by treatment with GA_3. Fruit Ca levels remained constant, on a per fruit basis, during the last 3 weeks of fruit maturation but Ca concentration, expressed as fresh or dry weight, decreased as a result of increased fresh and dry weight. Higher Ca levels were not associated with firmer fruit (comparing GA_3 and nontreated fruit), but were correlated positively with firmness in nontreated fruit.

760. Facteau, T. J. 1982. Relationship of Soluble Solids, Alcohol-insoluble Solids, Fruit Calcium, and Pectin Levels to Firmness and Surface Pitting in 'Lambert' and 'Bing' Sweet Cherry Fruit. J. Amer. Soc. Hort. Sci. 107(1):151-154.--Firmer 'Lambert' and 'Bing' sweet cherry fruit (Prunus avium L.) was associated with higher soluble solids (SS), higher concentration of alcohol-insoluble solids (AIS), and pectinase-soluble pectic substances and less crop, surface pitting, and lower concentration of water-soluble pectic substances. Fruit Ca and ethylene diamine-tetraacetic acid (EDTA) soluble pectic substances were not associated with fruit firmness. Total pectic substances were lower in AIS extracted with 70% ethanol held at 70°C for 1 hour as compared with AIS extracted with 70% ethanol at room temperature plus 80% ethanol in 5% HCl (v/v) for an additional hour. The major differences between the 2 methods were less EDTA and more pectinase pectins in 70°C ethanol-extracted AIS.

761. Mellenthin, W. M., P. M. Chen, and D. M. Borgic. 1982. In-line Application of Porous Wax Coating Materials to Reduce Friction Discoloration of 'Bartlett' and 'd'Anjou' Pears. HortScience 17(2):215-127.--'Bartlett' and 'd'Anjou' pears (Pyrus communis L.) were passed through several brushrollers during washing, rinsing, waxing, and drying sequences of a simulated packing process. In-line

application of Fresh-Cote, a wax coating formula with porosity, to the pear surface at waxing location of the packing line reduced peel discoloration of 'Bartlett', but not 'd'Anjou', because of brush friction. Fruits also were subjected to a return flow belt for 5 minutes to simulate the sorting sequence during packing. Fresh-Cote substantially reduced the susceptibility of both 'Bartlett' and 'd'Anjou' pears to peel discoloration from belt friction.

762. Kushad, Mosbah M., Daryl G. Richardson, and Adolph J. Ferro. 1983. Intermediates in the Recycling of 5-Methylthioribose to Methionine in Fruits. Plant Physiol. 73:257-261.--The recycling of 5-methylthioribose (MTR) to methionine in avocado (Persea americana Mill, cv Hass) and tomato (Lycopersicum esculentum Mill, cv unknown) was examined. [$^{14}CH_3$]MTR was not metabolized in cell free extract from avocado fruit. Either [$^{14}CH_3$] MTR plus ATP or [$^{14}CH_3$] 5-methylthioribose-1-phosphate(MTR-1-P) alone, however, was metabolized to two new products by these extracts. MTR kinase activity has previously been detected in these fruit extracts. These data indicate that MTR must be converted to MTR-1-P by MTR kinase before further metabolism can occur. The products of MTR-1-P metabolism were tentatively identified as α-keto-γ-methylthiobutyric acid (α-KMB) and α-hydroxy-γ-methylthiobutyric acid (α-HMB) by chromatography in several solvent systems. [^{35}S]α-KMB was found to be further metabolized to methionine and α-HMB by these extracts, whereas α-HMB was not. However, α-HMB inhibited the conversion of α-KMB to methionine. Both [U-^{14}C]α-KMB and [U-^{14}C]methionine, but not [U-^{14}C]α-HMB, were converted to ethylene in tomato pericarp tissue. In addition, aminoethoxyvinylglycine inhibited the conversion of α-KMB to ethylene. These data suggest that the recycling pathway leading to ethylene is MTR → MTR-1-P → α-KMB → methionine → S-adenosylmethionine → 1-aminocyclopropane-1-carboxylic acid → ethylene.

763. Andersen, P. C., and D. G. Richardson. 1982. A Rapid Method to Estimate Fruit Water Status with Special Reference to Rain Cracking of Sweet Cherries. J. Amer. Soc. Hort. Sci. 107(3):441-444.--A technique is described whereby osmotic potential, turgor potential and total fruit water potential can be determined quickly in the field with the aid of a pressure bomb, a hand held refractometer, and a percent soluble solids to osmotic potential conversion chart. A unique inverse linear relationship between percent soluble solids and osmotic potential was found for each fruit species. Application of this technique to rain cracking of 'Napoleon' sweet cherries (Prunus avium L.) shows that cracking is not strictly related to percent soluble solids, osmotic, turgor, or fruit water potential. This suggests that the degree of cuticular permeability, cuticular strength, cell wall strength or other factors may be of greater importance in determining cracking susceptibility than water potential parameters.

764. Meadows, Sylvia E. and Daryl G. Richardson. 1983. Interactive Effects of Ethylene Concentration and Storage Temperature on Budbreak and Viability of Dormant 'Viva' Roses. HortScience 18(4):453-454.--Dormant 'Viva' rose bushes kept at 0° or 5°C were subjected to 0, 1, 10, 100, or 1000 ppm ethylene for 4 weeks, then planted in containers and forced in the greenhouse. At planting, ethylene damage was not

apparent, except to the plants exposed to the combination of 5' and 1000 ppm ethylene. However, after 5 weeks of growth, there was progressively more cane mortality and less budbreak as ethylene concentrations were increased, with more damage for the 5° than the 0° treatments.

765. Richardson, D. G. and A. M. Al-Ani. 1982. Cork Spot of D'Anjou Pear Fruit Relative to Critical Calcium Concentration and Other Minerals. Acta Hort. 124:113-118.--Fruit mineral analyses from nine orchards showed that fruit Ca was negatively correlated with incidence and severity of cork spot (CS) both at harvest (r = -.75) and after storage (r = -.76) in both years. The N:Ca ratio was similarly correlated to CS at harvest and after storage (r = .74 and .75) although N alone was weakly correlated. Significant correlations between CS incidence and fruit Ca or N:Ca could be found as early as 120 days before harvest. Critical minimum D'Anjou fruit Ca is about 7 mg Ca per 100 g fresh weight for incipient cork spot. If the N:Ca ratio exceeds 10, CS can be expected to exceed 30% unless fruit Ca is greater than 8 mg per 100 g fresh weight. Correlations between CS severity and fruit Ca were highly significant (r = -.86) and water soluble Ca was more correlated with CS than was total Ca. Ranges of fruit Ca from non-lesioned, light, medium, and severely lesioned CS fruit were 8.1, 5.7, 4.8, and 3.8 mg Ca per 100 g fresh weight, respectively. Severity of CS was not correlated with B, N, K, P, Mg or any other minor elements.

766. Richardson, D. G. and A. M. Al-Ani. 1982. Calcium and Nitrogen Effects on D'Anjou Pear Fruit Respiration and Ethylene Evolution. Acta Hort. 124:195-201.--Calcium concentration in D'Anjou pear fruit was increased significantly by preharvest sprays (up to 30%) by postharvest dips (up to 150%) or by vacuum infiltration (up to 54%) with CaCl solutions. Increased Ca concentration in the fruit caused a significant reduction in respiration rate and ethylene evolution, and fruit Ca concentration was significantly inversely correlated with respiration rate (r = -0.83) and ethylene evolution (r = -0.87) during ripening at 20°C. An even greater correlation (r = -0.91) existed between water-soluble Ca and respiration rate than did total (acid-extractable) Ca and respiration rate (r = -0.87). Fruit firmness was increased by 1.1 kg from increased fruit Ca, but internal ethylene was also slightly increased by 5% CaCl dips. Fruit low in Ca (less than 7 mg per 100 g fresh weight) required a much shorter duration of cold storage before acquiring the ability to ripen compared with fruit having greater Ca. Fruit with N:Ca greater than 10:1 also had shorter storage durations to ripen. This rapid ripening of low Ca, or high N:Ca ratio fruit was related to greater initial and peak ethylene evolution. High Ca fruit required a longer cold storage period to begin ripening, and after six months at -1°C the fruit retained firmness and stronger ethylene synthesis during 20°C ripening better than fruit with lower Ca.

767. Lombard, P. B. and D. G. Richardson. 1982. Increase Fruit Set and Cropping of 'Comice' Pear Trees with an Ethylene Inhibitor, Amino-Ethoxyvinylglycine. Acta Hort. 124:165-169.--Young 'Comice' trees are notorious for low fruit set and crops. Because of previous success with amino-ethoxyvinylglycine (AVG) on apples to increase

fruit set (Williams, 1980), AVG treatments were applied on 7 year old 'Comice' trees at full bloom (FB), 2 weeks after bloom (FB+2), and 4 weeks after bloom (FB+4) at concentrations of 150, 300 and 600 mg/1. Fruit set (FS) and yield efficiency (E) were increased significantly with all concentrations and at all timings with AVG. Greatest FS and E were found with AVG at FB+2 wks. and at the highest concentration. Fruit size and rate of fruit growth were reduced by AVG at FB for all concentrations and at both post-bloom applications at 600 mg/1. All AVG applications caused fruit russeting and leaf injury but the level of injury was related to concentration only. Bloom density was reduced the following year by AVG applied FB+2 at the 2 highest concentrations. Fruit maturity and storage quality of 'Comice' were not influenced by AVG.

768. Lombard, Porter B. 1982. Special Considerations in Orchard Design, Training and Pruning Systems for Pear Trees. Acta Hort. 124:171-175.--Much of the information developed for training and pruning apple orchards has been used for pears because of similarities in growth and fruiting habit. There are, however, major growth differences: there are no triploid commercial pear cultivars, which would present the problem of rank growth, nor spur-type mutants which maintain some growth control; few semi-dwarfing pear rootstocks have been available, except quince which can only be grown under specific conditions and is incompatible with certain cultivars; susceptibility to loss of leaders or laterals of a pear tree because of fire blight, and the greater physical strength of pear wood, allowing narrower crotch angles. Cropping of pear trees can be altered more by pruning methods than can apple trees, because head pruning of pear trees can increase fruit set dramatically. Lack of biennial bearing of pears requires less attention to fruit thinning and to corrective pruning measures than has been necessary for most apple cultivars. Growth regulants that are useful for apple training and bloom promotion are seldom registered or active on pear trees. These growth and fruiting differences are some of the considerations in research for the development of new pear orchards and pruning of pear trees.

769. Lombard, Porter, Victor Guerrero, and Maxine Thompson. 1983. Pollination and Fertility of Sweet Cherries, Royal Ann Pollination in Western Oregon. Proc. Ore. Hort. Soc. 74:121-127.--Pollen tube growth of several pollinizers in Royal Ann flowers which were evaluated at various temperatures varied according to pollinizer: Bada and Black Republican pollen tube growth rate was less dependent on temperature than Corum, 5-3 days to reach the stylar base versus 9-3 days respectively between 45 and 61°F. Effective pollination period was 4-5 days long for Royal Ann flowers.

770. Lombard, Porter. 1981. Production of Quality Bosc Pears. Proc. Ore. Hort. Soc. 71:18-22.--Establishment of a Bosc orchard requires clean budwood free of stony pit virus; a rootstock with good anchorage and compatibility preferably not quince; active training and pruning to control the rank growth like head pruning and summer tipping; and a late blooming pollinizer. Operation of a mature Bosc orchard and harvest of Bosc pears are discussed.

771. Lombard, Porter. 1983. Effect of Rootstock, Pollinizer, Spacing, Row Orientation and Frost Protection in Bringing Young Pear Trees into Bearing. Proc. Ore. Hort. Soc. 74:57-60.--Several rootstocks are available for pears but none are dwarfing. They are: Provence Quince BA29, Quince A and C are best for Comice but they are not hardy; Calleryana seedling is compatible with all varieties and somewhat hardier and have good anchorage; OH x F clonal stock series has a range of tree size control besides being hardy and compatible; Bartlett and Nelis seedling stock are similar to Calleryana but hardier; Betulaefolia seedling is least precocious and produces the largest tree and generally recommended for small fruited pears as Seckel, Bartlett, 20 Century, Shinseiki, and Chojoro. Pollinizer spacing, tree spacing, row orientation, and frost control are discussed for bringing pear trees into bearing by 5-7 years.

772. Lombard, P. B. 1982. Pear Pollination and Fruit Set. p. 91-103 in The Pear edited by T. Van der Zwet and N. F. Childers.--The pollination process, the fertility of various cultivars, the effect of rootstock and nutrition on fruit set, a pollinizer chart with bloom periods and fertility from cross, self, and parthenocarpy, pollinators for pears, effective pollination period and pollen tube growth of pears are discussed.

773. Mullin, C. A. and B. A. Croft. 1983. Host-Related Alterations of Detoxification Enzymes in Tetranychus urticae (Acari:Tetranychidae). Environ. Entomol. 12:1278-1282.--Host-dependent changes of four detoxification enzymes in Tetranychus urticae Koch were investigated in mites adapted to 14 plant species in 10 families. Relative to a snapbean-adapted mite strain, differences for aldrin epoxidase ranged from 0.4- to 1.5-fold, trans-epoxide hydrolase 0.5- to 1.5-fold, cis-epoxide hydrolase 1- to 3.4-fold, and -naphthyl acetate esterase 0.4- to 2.4-fold. These host-related differences are much less than reported in other arthropods such as the Noctuidae. Hence, this broadly polyphagous mite may rely only in part on metabolic detoxification to protect it from toxic phytochemicals. Prospects of sequestering plant allelochemicals as an alternative defensive strategy are discussed.

774. Westwood, M. N. 1982. Pear Germplasm of the New National Clonal Repository: Its Evaluation and Uses. Acta Hort. 124:57-65.--Populations of all of the world's Pyrus species are represented, plus more than 1000 cultivars and rootstock clones. Studies and observations indicate that genes exist within the genus for resistance to: pear decline, fire blight, bacterial canker, Fabraea leaf spot, crown gall, Phytophthora root rot, pear psylla, pear leaf blister mite, wooly pear aphid, codling moth and root lesion nematodes. Also found were genes for tolerance to lime-induced chlorosis, wet soils, dry soils, acid soils, cold winters and warm winters. Other genetic traits in the collection regulate bloom date, bud-chilling requirement, leaf margin and shape, tree size (dwarfing), fruit skin color, fruit stone cells, deciduous calyx, carpel number, and fruit size. Some work has been done on the relation of leaf poly-phenols to pest resistance and to the taxonomy of the genus. Rootstock efficiency and mineral nutrient uptake have been the subject of intensive study with this germplasm collection.

775. Westwood, M. N. 1982. A History of Pear Growing in Oregon and the Northwest. Acta Hort. 124:11.--Pear growing in the Pacific Northwest is a young industry, relative to western Europe. When Alexander MacKenzie traversed the Canadian Rockies and "discovered" the west coast of North America in 1793, there were no pears of any kind growing here, nor were there any white settlers. Likewise, when Lewis and Clark overwintered in western Oregon in 1805, the situation was unchanged. By 1825, Dr. McLoughlin, chief factor for the Hudson's Bay Company, was planting fruit trees at Fort Vancouver, Washington. Probably pears were among them. Young David Douglas was at that time collecting wild fruit species and other plants of the Northwest on behalf of the Royal Horticultural Society of London. In 1836 and shortly after, Dr. Marcus Whitman established pears and other fruits at his Christian mission near Walla Walla, Washington, and four years later, the father of J. H. Stewart of Medford brought pear trees from Hannibal, Missouri, to establish the first pear orchards in the Rogue River Valley of Oregon. In 1847, the Lewelling fruit tree nursery was established just south of Portland, and in 1850, Henry Settlemier established a nursery at Tangent, Oregon, just east of Corvallis. These nurseries soon made available pear trees in sufficient numbers to plant many commercial orchards in western and southern Oregon. The Oregon Agricultural College was established in 1868, and in 1872 listed the first classes in fruit growing. The Oregon Agricultural Experiment Station was established in 1888 and the first bulletin on pear and fruit culture was published by E. R. Lake in 1889. Research on pear culture has continued since that time.

776. Westwood, M. N. and R. L. Stebbins. 1982. Cherry Variety and Rootstock Research in Oregon. Proc. Int. Cherry Res. Conf. pp. 7-9.--Replant trials were done for both sweet and sour cherries. The sweet cherry plot was on an old sweet cherry site and the one for sour cherry was on an old prune plot. With sweet cherry after 2 years growth, the most striking benefit (39% increase) was in using the backhoe rather than the auger. Fumigation resulted in an 11% increase in growth, but the use of K, Mg and P appeared of no benefit. With the use of 3 different rootstocks in the test, there was no apparent interaction between rootstocks and chemical or physical treatments. Using F 12/1 Mazzard as the standard, M x M 60 stock was 14% larger and Colt was 22% smaller. These trees are being topworked to Napoleon in 1981-82. The sour cherry plot is near Yamhill in a silty clay loam soil which had previously been in Italian prunes (peach root). The land was cleared and disced but no other preplant preparation was done. All holes were hand dug and trees were hand planted in February 1980. The trees were given normal care, but no irrigation was provided. In this test the only variable measured was rootstock, of which there were 4. The trees will be top grafted to Montmorency in 1982. Again using F 12/1 Mazzard as the standard after 2 years growth, M x M 60 was 96% larger, Colt was 28% larger, M x M 97 was the same size, and M x M 14 was 81% smaller. The latter stock does not appear to be adapted to that nonirrigated soil. It was earlier found to be deficient in K in another soil in which trees on F 12/1 were not deficient.

777. Westwood, M. N. and P. B. Lombard. 1982. Rootstocks for Pear. Proc. Ore. Hort. Soc. 73:64-79.--Research on pear rootstocks in Oregon began on a grand scale with F. C. Reimer's work in 1915 and continued at a reduced rate from 1925 to 1948. With the advent of pear decline, a disease related to rootstock, intensive work was again resumed in 1960, involving pathologists, entomologists, nematologists, soil scientists and pomologists. This work ultimately resulted in a number of significant papers relating to fire blight, root rot, insect resistance, virus, mineral nutrition, and general performance. Pear decline was determined to be caused by a mycoplasma organism transmitted to the trees by psylla insects feeding on the leaves. A more complete summary of our 22 years of rootstock research was published last year. Although remission of pear decline can be achieved by trunk injections with tetracyline, it is expensive and must be repeated. The most satisfactory solution is the use of genetically resistant rootstocks. The Oregon team has identified a number of decline-resistant stocks, many of which also are resistant to other pests and diseases and which induce productivity in the scion. Clonal selections have been made which incorporate a number of these desirable traits, plus dwarfing in some. No single stock is suitable to all soils, climates and varieties, but a group of stocks have been developed, each adapted to a particular set of conditions.

778. Jahn, O. L. and M. N. Westwood. 1982. Maintenance of Clonal Plant Germplasm. HortScience 17(2):122.--Clonally propagated plants must be maintained living plants, obtained by grafting a scion from the original tree to a rootstock, or by rooting a cutting from the original. A collection of plants with unique traits of potential value in crop production is one objective of the National Plant Germplasm System (NPGS). Other objectives include the maintenance, evaluation, and distribution of such genetic stocks (germplasm). Until recently, Rubus and most other clonally propagated crops were not maintained in NPGS collections. Although germplasm of all crops has been collected, the maintenance of germplasm within NPGS has been largely limited to seed-propagated crops like corn, tomatoes, beans, etc. Clonal crop germplasm has been maintained in working collections for use in breeding or for other purposes. These collections have not been adequate to provide for the increasing use of species material in breeding programs; they have not been coordinated to provide for access to germplasm or to reduce unnecessary duplication. Furthermore, they have not prevented the loss of germplasm, including species that now are becoming extinct in their native habitats. Adequate germplasm resources are necessary to continue the improvement of these crops and to insure that these resources are available in case of an emergency, such as a disease outbreak. This is especially true since most of our crops were introduced species and therefore have no native gene sources. National Clonal Germplasm Repositories are being established in Oregon, California, New York, and elsewhere to preserve valuable genetic material of all important fruit and nut crops.

779. Westwood, M. N. 1982. Rootstocks for Pear: Pick with Care. Amer. Fruit Grower, West. Ed. 102(11):26-28.--More than 70 year's research on pear rootstocks in Oregon has indicated a great deal of genetic diversity in the various graft compatible stocks available. In

addition to high yield efficiency we have found such traits as hardiness, low chilling, dwarfing, tolerance to high and low soil pH and to waterlogging, resistance to various root rots, nematodes, insects, and diseases. Because of the great diversity of climates, soils and pests of pear, it is unlikely that a single, universally suited rootstock will be found. But several superior clonal stocks have been developed, each being suitable to a specific set of growing conditions.

780. Rajashekar, C., M. N. Westwood, and M. J. Burke. 1982. Deep Supercooling and Cold Hardiness in Genus Pyrus. J. Amer. Soc. Hort. Sci. 107(6):968-972.--Deep supercooling was found in the stem tissues of all the Pyrus species studied. There was more than 1 low temperature exotherm resulting from the freezing of supercooled water in stem tissue, and these exotherms were associated with the tissue injury. The supercooled water in the stems of P. nivalis Jacq., P. cordata (Desv.) Schneider and P. elaeagrifolia Pall. was found in both xylem and bark tissues. The supercooling characteristics of vegetative and flower buds are also described. The hardiest and least hardy species found were P. caucasica Fed. and P. pashia D. Don., respectively.

781. Westwood, M. N. 1982. Pear Rootstocks for the Northwest. Proc. Wash. State Hort. Assoc. 78:155-158.--Pear production started in the Pacific Northwest in about 1840 in Southern Oregon and in the 1850s in Oregon's Willamette Valley. Toward 1900 with the coming of the railway and the development of irrigation, pear production developed in the Hood River Valley in Central and Eastern Washington. At that time neither pear psylla nor pear decline was present in the Northwest, so the need for special rootstocks was not yet apparent. The disease pear decline is caused by mycoplasma that is transmitted by pear psylla feeding on leaves. The organism moves downward in living bark causes death of conducting tissue just below the graft union when susceptible rootstocks are used. This effectively girdles the tree, resulting in death or severe weakness. Remission of pear decline has been achieved by trunk injections with tetracycline, but it is expensive and must be repeated. The most susceptible rootstocks, Pyrus pyrifolia (serotina) and P. ussuriensis should no longer be used. Recent work in Oregon has centered on the development of superior clonal rootstocks that are resistant to decline. Of the new rootstocks available, P. calleryana, P. betulaefolia and quince are not hardy to the coldest areas of the northwest. Several clones of Old Home x Farmingdale are hardy to those areas.

782. Westwood, M. N. and P. B. Lombard. 1983. Pear Rootstocks: Present and Future. Frt. Var. Jour. 37(1)24-28.--Early work on pear rootstocks in the west centered around the search for resistance to fire blight (Erwinia amylovora (Bur.) Winslow, et al). F. C. Reimer collected blight resistant stocks such as Old Home and Farmingdale of European origin as well as a number of primitive species from Asia. With the appearance in the 1950s of the new disease "Pear Decline," research was renewed on pear rootstocks in the western states. It was learned that Pear Decline is caused by a pathogen, probably a mycoplasma, injected into the trees by infected psylla insects feeding on the leaves. The pathogen moves through the living bark downward to the root. If the rootstock is susceptible, phloem necrosis

occurs below the graft union, causing the tree to die. Resistance to Decline was shown to be genetically controlled. In 1960, we began a series of pear rootstock trials to study not only Pear Decline but a wide array of other environmental and biotic factors, including growth control and cropping efficiency. We have learned that no single rootstock is suitable to every situation. After 22 years' research we have developed a few suitable rootstocks representing P. communis (several clones of Old Home x Farmingdale), P. calleryana, and P. betulaefolia. Some quince stocks were found suitable to southern Oregon and California. For the future tests have been under way for several years with many of the exotic stocks of the worldwide Pyrus collection (now part of the national clonal repository, USDA-OSU) and with several genera of the subfamily Pomoideae (Amelanchier, Crataegus, Malus, Sorbus). These stocks offer additional diversity in tolerance to certain soils and environments and in dwarfing. Extremes are available in adaptability to soil conditions. Those most adapted to wet, acid soils are P. fauriei, P. pashia and P. dimorphophylla. Those best suited to dry, alkaline soils are P. amygdaliformis, P. elaeagrifolia, P. syriaca and P. cordata. Growth control has been found in P. fauriei, P. cordata, P. syriaca, Amelanchier, Crataegus, Sorbus and Cydonia. Also extreme dwarfing has been found with M 26 apple stock, using a Winter Banana apple interstem which affords compatibility with pear scions. A number of clonal selections have been made of these various seedling stocks with the objective of combining genetic adaptation with uniform tree size and consistent productivity. We plan to introduce some of these clones within the next 5 years. A comprehensive list of research papers on the evaluation of Pyrus at the Northwest Plant Germplasm Repository, USDA-OSU, was published in 1981. It includes studies on genetics/breeding, physiology, propagation, taxonomy, pathology, entomology, phytochemistry, and rootstock behavior.

783. Timmis, K. A. and L. H. Fuchigami. 1982. The Relationship of Impedance Ratios and Stem Moisture Content to Vegetative Maturity and Dormancy in Red-osier Dogwood. J. Amer. Soc. Hort. Sci. 107(5):888-890.--Electrical impedance ratios and water contents were measured during the development of vegetative maturity and dormancy in a clone of red-osier dogwood (Cornus sericea L.) on plants exposed to 16 hour and 12 hour photoperiods in growth chambers to selectively prevent or induce dormancy. Vegetative maturity was designated as the point at which buds were no longer stimulated to grow following artificial defoliation. After this time the ratio of impedance values obtained from the frequencies 10 kHz:100kHz increased and tissue water decreased. Electrical impedance ratios were more easily measured and showed less variation between plants. We conclude that electrical impedance ratios are a means of identifying the onset of vegetative maturity and dormancy in woody deciduous species.

784. Kobayashi, Kent D., Leslie H. Fuchigami, and Marshall J. English. 1982. Modeling Temperature Requirements for Rest Development in Cornus sericea. J. Amer. Soc. Hort. Sci. 107(5):914-918.--Temperature requirements for rest development were determined and used in developing an empirical model for predicting rest development in terminal vegetative buds of Cornus sericea L. Vegetatively mature plants were exposed to 5° to 20°C under a 12-hr photoperiod (SD) in

growth chambers, and depth of rest was measured by days to terminal bud break at 20°/15° (day/night) under a 16-hour photoperiod (LD). Rest development proceeded only after vegetative maturity was attained. Time from vegetative maturity to maximum rest decreased with decreasing temperature. Rate of rest development at all temperatures varied and was dependent on growth stage. The annual growth cycle and rest development were described and quantified by a degree growth stage (°GS) model. Using temperature and accumulating °GS, the model predicted maximum rest within 2 days in both years.

785. Kobayashi, Kent D. and Leslie H. Fuchigami. 1983. Modeling Bud Development During the Quiescent Phase in Red-osier Dogwood (Cornus sericea L.). Agric. Meteorol. 28:75-84.--Stages of bud development during the quiescent phase were numerically expressed by a degree growth stage (°GS) model. This phase extends from the end of rest (315° GS) to spring bud break (360° GS). This study determined temperature effects on bud development at different developmental stages during the quiescent phase. Results were used to develop a model for predicting daily bud development and spring bud break. At monthly intervals during the quiescent phase red-osier dogwood (Cornus sericea L.) plants were exposed in growth chambers to temperatures of 5-20°C and a 12-h photoperiod. Plants were placed in a greenhouse at 20/15°C day/night temperatures and a 16-h photoperiod, and bud development evaluated on the basis of time required for terminal vegetative buds to break. Bud development increased with increasing temperatures, from 5 to 20°C, and with increasing bud development from 315 to 360°GS. In two years of study a model was developed, which used bihourly temperatures and accumulating °GS to predict daily bud development and spring bud break within three days.

786. Kobayashi, K. D. and L. H. Fuchigami. 1983. Modelling Temperature Effects in Breaking Rest in Red-osier Dogwood (Cornus sericea L.). Annals of Bot. 52:000-000.--Temperature requirements for bud development after a rest period (breaking rest) from maximum rest to end of rest were determined to develop an empirical model for predicting rest development in terminal vegetative buds of red-osier dogwood (Cornus sericea L.). One-year-old plants at maximum rest were exposed to temperatures from 5 to 20°C with a 12 h photoperiod (SD) in growth chambers. Depth of rest was measured by days to bud break in either 16 h photoperiod (LD) or natural daylength at 20/15°C day/ night temperature. Developmental stages during rest development were expressed by degree growth stage (°GS). Chilling was effective breaking rest after plants attained maximum rest (270 °GS). Development during rest (breaking rest) increased with decreasing temperature. No significant development occurred at 20°C. Rate of rest development (°GS h^{-1}) at all temperatures varied during the breaking rest period and depended on developmental stage (°GS). A °GS model described and quantified rest development (°GS). Using temperature and developmental stage, the model predicted end of rest (315 °GS) within 3 days of daily rest development (°GS) in both years.

787. Kobayashi, Kent D., Leslie H. Fuchigami, and Conrad J. Weiser. 1983. Modeling Cold Hardiness of Red-osier Dogwood. J. Amer. Soc. Hort. Sci. 108(3):376-381.--Effects of temperature on cold acclimation and deacclimation of red-osier dogwood (Cornus sericea L. syn. Cornus

stolonifera Michx.) plants were determined at different stages of plant development. Results were used to develop models for predicting stem hardiness. Acclimation and deacclimation rates were related to temperature and plant developmental stage (expressed as degree growth stage, °GS). Decreasing temperature promoted increasing acclimation. Maximum acclimation rates in the temperature range of 5° to 20°C occurred at maximum rest (270°GS). During the decreasing rest phase (270 to 315°GS), deacclimation occurred at temperatures from 7° to 20°C. At earlier stages of development (315° and 335°GS) during the quiescent phase (315 to 360°GS), 5°C was the only temperature that promoted hardiness, whereas at a later stage (341°GS) all temperatures tested caused deacclimation. The models, using bihourly temperatures and accumulating °GS, predicted hardiness within an average deviation of 4.7°C.

788. Zwick, R. W. 1983. New Directions and Materials for Pear Pest Management. Proc. Ore. Hort. Soc. 74:10-12.--The important pests of pear are discussed from the standpoint of their control with cultural, chemical, and biological control agents. Various examples are drawn to illustrate the benefits and drawbacks to these various types of control.

789. Zwick, R. W. 1983. Dimethoate--What Do We Know About It? Proc. Ore. Hort Soc. 74:116-117.--The previous use experience with dimethoate on sweet cherry as a fruit fly preventive is discussed from the standpoint of efficacy, residues on fruit, and effects on nontarget phytophagous and predatory mites detailed. No resurgences of two-spotted or McDaniel spider mites occurred in several commercial orchards where dimethoate was used.

790. Heatherbell, D. A., M. S. Reid, and R. E. Wrolstad. 1982. The Tamarillo: Chemical Composition During Growth and Maturation. New Zealand Journal of Science 25:239-243.--Tamarillo (Cyphomandra betacea, red strain) fruits of known age were sampled for analysis of their chemical composition at all stages from newly set to fully mature. Concentrations of total nitrogen, starch, pectins, anthocyanin pigments, and individual sugars and acids were measured. Changes throughout the process of maturation are discussed in relation to the physiology of the fruit. Fruits grew rapidly and reached full size about 16 weeks after anthesis; maturity was attained 11 weeks later, at about 27 weeks. Marked changes in skin and pulp color occurred during development. Total nitrogen varied little. Starch content, which during development reached 14% of fresh weight, fell to less than 1% at maturity. At their maximum, total sugars (mainly sucrose, glucose, and fructose) attained 5% of fresh weight. As fruits matured to eating ripeness, the initially high concentrations of both anthocyanins and acids in the flesh decreased substantially; proportions of the different pectic compounds also altered.

791. Cornwell, Christopher J., Ronald E. Wrolstad, and Felix G. R. Reyes. 1982. Effect of Sucrose Addition on the Sugar and Sorbitol Composition of Frozen Sweet Cherries and Their Derived Concentrates. J. Food Sci. 47(1):281-283,290.--Glucose, fructose, sucrose, and sorbitol contents of Van and Black Republican varieties of sweet cherries were determined by high performance liquid chromatography (HPLC) and en-

zymic analytical procedures. Samples analyzed included frozen fruit, fruit packed as 3.6 parts fruit plus 1 part added sucrose, and cherry juice concentrates derived from the sugar-packed fruit. Cherry fruit showed invert patterns of glucose and fructose and contained trace amounts of sucrose, and 2.6-3.9g sorbitol/100g. Sucrose was either not detected or found in trace amounts in samples to which sucrose had been added. There is evidence that sucrose hydrolysis was caused by presence of invertase. The percent sorbitol content could be used to detect addition of sucrose. Results for sugar and sorbitol content as determined by HPLC or enzymic methods were very similar.