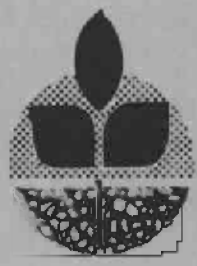


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Oregon Tree Fruit and Nut Research Abstracts 1978-1979



Special Report 598

July 1980

Agricultural Experiment Station
Oregon State University, Corvallis

OREGON TREE FRUIT AND NUT RESEARCH ABSTRACTS
1978-1979

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

Compiled by M. N. Westwood
Professor of Horticulture

INTRODUCTION

The index which follows is complete through 1979 and includes all the abstracts from Special Reports 341, 355, 417, 461, and 512 plus items 571 through 653 of the attached supplement. For best use of this abstract supplement, it should be attached to Special Reports 341, 355, 417, 461, and 512.

As was done with the earlier compilations, full reprints of papers 571 through 653 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

571. Kirk, D. E. and D. E. Booster. 1979. Identifying damage sources in mechanically harvested sweet cherries. *Trans. of the ASAE.* 22:21-26.-- The character of the tree, crop, and weather and the parameters of energy transfer to the tree by mechanical harvesters were studied to seek correlations between controllable factors and fruit damage in the mechanical harvesting of sweet cherries for brining. Correlations observed between tree trunk displacement during the shaking process and fruit damage have led to modification of the harvest machines.
572. Abers, J. E. and R. E. Wrolstad. 1979. Causative factors of color deterioration in strawberry preserves during processing and storage. *J. Food Sci.* 44:75-81.-- Factors responsible for the differences in color quality between preserves commercially manufactured from Hood and Tioga strawberry varieties were determined. Color analyses on Hood and Tioga preserves during a 26-wk storage period revealed that color deterioration occurred at a much faster rate in Tioga preserves than in Hood preserves, and that this deterioration was due to a faster rate of browning. Compositional analyses of fruit showed that the Tioga variety contained higher levels of leucoanthocyanins, flavanols and total phenolics while the Hood variety contained higher levels of anthocyanin pigment, ascorbic acid, and free amino acids. It is proposed that reactive phenolics (leucoanthocyanins, flavanols) play a major role in the color deterioration of strawberry preserves.
573. Facteau, T. J., S. Y. Wang and K. E. Rowe. 1978. Response of sweet cherry leaf tissue to hydrogen fluoride fumigation at different nitrogen levels. *J. Amer. Soc. Hort. Sci.* 103(1):115-119.-- Foliar uptake of fluoride (F) resulting from hydrogen fluoride (HF) fumigations was linear with dose (concentration F in $\mu\text{g}/\text{m}^3 \times$ duration of exposure in hours) at F concentrations lower than $17.5 \mu\text{g}/\text{m}^3$. Above this level, duration of exposure was the only important factor and uptake was non-linear with time. Higher leaf N levels resulted in greater F uptake. Production of CO_2 was increased more by F concentration for short periods than by low concentration for longer periods where leaf N was optimal or supraoptimal. Amino nitrogen (AN) levels increased more at low F concentration for longer periods than high concentration for shorter periods. The response patterns were similar at optimal and supraoptimal leaf N. Protein nitrogen (PN) decreased with increasing ln HF dose at optimal and very low leaf N levels. Changes in pH and AN were significantly correlated in leaf tissue with optimal, but not in tissues with deficient or supraoptimal N.
574. Facteau, T. J. and K. E. Rowe. 1979. Growth, flowering, and fruit set responses of sweet cherries to daminozide and ethephon. *HortSci.* 14(3): 234-236.-- Factorial combinations of 50 and 100 ppm (2-chloroethyl) phos-

phonic acid (ethephon) and 1000, 2000 and 4000 ppm succinic acid-2, 2-dimethyl hydrazide (daminozide) sprayed on young 'Napoleon' sweet cherry trees (Prunus avium L.) for 3 consecutive years showed no antagonistic or synergistic effects on either growth or flowering. Daminozide, at 2000 and 4000 ppm, reduced terminal growth but had no effect on flower initiation or flower density. Ethephon significantly reduced growth only the first year applied and appeared to increase flower initiation on wood previously untreated. Daminozide at 4000 ppm reduced fruit set on all combinations of year-wood and years but when applied at a concentration of 2000 ppm reduced set only 2 out of 5 possible year-wood, year combinations. Ethephon reduced set 3 out of the 5 year-wood combinations but the average response was not significant.

575. Facticeau, T. J. and K. E. Rowe. 1979. Factors associated with surface pitting of sweet cherry. *J. Amer. Soc. Hort. Sci.* 104(5):706-710.--Six annual surveys indicated that % soluble solids and fruit weight were the only consistent predictor variables for fruit surface pitting in 'Lambert' sweet cherry (Prunus avium L.). Both were inversely related to pitting. Similar associations were found 'Bing' when fruit were handled excessively. In spite of tree-to-tree variation, the degree of pitting was relatively uniform in a given orchard in a given year. High and low percentage pitting orchards appeared to be fairly consistent over the 6 years, but intermediate ones were extremely variable. Postharvest factors (time delay prior to storage, hydrocooling temperature, or storage temperature) had little or no effect on surface pitting. Foliar sprays of gibberellic acid (GA₃ or GA₄₊₇) applied 3 weeks prior to harvest increased fruit firmness and reduced color. Gibberellic acid sprays reduced pitting when the disorder was present (1974 and 1976) or where the fruit were bruised. Mechanical bruising of cherries increased the incidence of pitting. Surface pitting of sweet cherries may be caused by bruising but fruit characteristics (% soluble solids, size and firmness) can indicate whether or not pitting may occur on bruised fruit.
576. Hansen, E. and W. M. Mellenthin. 1979. Commercial handling and storage practices for winter pears. *Agric. Exper. Station. Bulletin* 550.--No abstract submitted.
577. Mellenthin, W. M. 1978. Factors affecting chemical thinning of Bartlett's. *Oregon Hort. Soc.* 69:54-55.--No abstract submitted.
578. Mellenthin, W. M. and K. L. Olsen. 1978. Carbon dioxide treatment of D'anjou pears for CA storage. *Wash. State Hort. Assoc.* 74:183-184.--No abstract submitted.
579. Mellenthin, W. M., E. Burts, R. Zwick, R. Rackham, R. Covey and C. Peters. 1978. Are pear growers achieving success with current insect and disease programs? *Wash. State Hort. Assoc.* 74:175-183.--No abstract submitted.
580. Mellenthin, W., D. Kethie, T. Raese, T. Cowan, M. Roys and R. Redman, Jr. 1979. Factors of pear quality and production - A panel discussion. *Proc. Wash. Hort. Assoc.* 75:177-189.--No abstract submitted.

581. Chaplin, M. H. and A. R. Dixon. 1979. The development of standard ranges for leaf nitrogen in the filbert. *J. Amer. Soc. Hort. Sci.* 104 (5):710-712.--Nitrogen, as urea, was applied to filbert (*Corylus avellana* L.) trees at the rates of 0, .68, 1.36, and 2.72 kg N/tree/year from 1971-1977. Nitrogen applications significantly increased leaf N, yield, and tree size. Leaf P levels were reduced by N applications in all years. Soil pH, measured after 7 years of N application, significantly declined as N application rate increased. Leaf Mn levels were increased by N applications in all years, probably due to the decrease in soil pH. Yields were expressed as a quadratic function of N and the standard ranges for leaf N in filbert were categorized as follows: deficiency (visible symptoms present) < 2.0% dry weight; below normal 2.0-2.2%; normal 2.2-2.4%; above normal > 2.4%.
582. Callan, N. W., M. M. Thompson, M. H. Chaplin, R. L. Stebbins and M. N. Westwood. 1978. Fruit set of 'Italian' prune following fall foliar and spring boron sprays. *J. Amer. Soc. Hort. Sci.* 103(2):253-257.--A pre- or postharvest foliar B application was found to increase fruit set of 'Italian' prune (*Prunus domestica* L.). A prebloom B spray failed to increase set. Neither fall nor spring applications influenced the amount of fruit lost in the midsummer or "blue" drop. All trees involved in the experiment had adequate B by the standard index of tree nutrition, August mid-shoot leaf analysis. Incipient B deficiency did not appear to be involved. Fall foliar B increased B levels in dormant bud and spur tissue and in flower buds and flowers. A prebloom B spray increased B levels of floral tissues to a lesser degree. The highest B concentration was found in the ovary. Boron concentration in flower buds in April following a fall B spray was as much as five times the amount found in mid-shoot leaves in August. August mid-shoot leaf analysis revealed higher levels in leaves from trees treated the previous fall in only one of the 2 years. Several morphological and physiological effects of the fall B spray were observed. Among these were a slight delay in the time of bud break, a decrease in the size of flower buds and mature flowers accompanied by reduction of style and pedicel length, and a decrease of pollen germinability. B level of pistil and pollen has no effect on *in vivo* pollen tube growth rate.
583. Thompson, M. N. 1979. Incompatibility alleles in *Corylus avellana* L. cultivars. *Theor. Appl. Genet.* 55:29-33.--Pollen stigma compatibility relationships are reported for 55 filbert cultivars (cvs) (*Corylus avellana* L.). A total of 11 S-alleles have been identified amongst 36 cvs for which one or both S-alleles have been established. For the 20 cvs with only one known allele and the 17 for which neither allele have been identified further information is provided as to which allele can be excluded as possibilities.
584. Thompson, M. N. 1979. Genetics in incompatibility in *Corylus avellana* L. *Theor. Appl. Genet.* 54:113-116.--Diallele crosses of sibs and parents of 3 parental combinations demonstrated sporophytic type of incompatibility in *Corylus avellana* L. One gene with multiple alleles was indicated. All 6 alleles present in the 4 parental cultivars and in

their progeny exhibited dominance in pollen and independent action in the pistil. Individuals homozygous for S-alleles appeared in progeny of parents having one allele in common. Reciprocal differences occurred in some crosses.

The stigmatic surface is the site of the incompatibility reaction. Incompatible pollen germinated abundantly but failed to penetrate into the stigma cells.

585. Thompson, M. N. 1979. Growth and development of the pistillate flower and nut in 'Barcelona' filbert. J. Amer. Soc. Hort. Sci. 104(3):427-432.--Growth and development of the pistillate flower and fruit in Corylus avellana L. cv. Barcelona, was studied from anthesis (January) to maturity (September). Ovary growth is very slow for about 4.5 months, proceeds very rapidly for about 6 weeks, during which time 90% of the increase in diameter occurs, and then abruptly ceases. Ovule development, megasporogenesis, megagametogenesis, and fertilization are described. At the time of pollination (January) the pistillate flower consists of a pair of stigmatic styles joined at their bases by a minute ovarian meristem. Pollen tubes reach the base of the style in 4 to 7 days. The sperm nucleus remains in the pollen tube tip in a resting stage until mid-June (about 5 months). During this period the basal meristematic cells develop into a mature ovary. Multiple megasporocytes, derived directly from archesporial cells, give rise to several megaspores, partly developed embryo sacs, and one normal embryo sac. When the sac is mature a secondary pollen tube, bearing the sperm, grows basipetally from the resting site in the upper tip of the ovary. It proceeds through the funiculus of the anatropous ovule, along the single integument, enters the nucellus through the chalazal end, and penetrates the micropylar end of the embryo sac where the sperm is ejected. While pollination is necessary to initiate ovary development, only a small percentage of the pollinated pistils develop into a full size nut. Fertilization is necessary for the formation of normal nuts with embryos. Full size nuts which are empty at maturity result from pollination without fertilization or from embryo abortion.

586. Thompson, M. M. 1979. Radiation-induced mutations in Prunus avium L. cv Napoleon. Environ. and Exper. Botany. 19:291-301.--Dormant scions of "Napoleon ("Royal Ann") sweet cherry were subjected to gamma rays from a ⁶⁰Co source. Primary (V₁) shoots are described and the frequency and types of mutations are reported for secondary (V₂) shoots, especially as related to exposure dosage and to bud position on the V₁ shoot from which V₂ trees originated. The most favorable exposure to induce mutations was 4.0-4.5kR. Including all exposures (3.0-5.0kR), there was an overall frequency of 6.72% partial plant mutants, 1.94% total plant mutants and 0.10% compact mutants. While the lowest buds (3rd-10th from the base of V₁ shoots) gave a significantly higher overall frequency of mutations in subsequent V₂ trees, the higher buds (11th-37th) gave a relatively higher frequency of total plant mutants. The genetic results are discussed in relation to the type of radiation damage reported for apical meristems in this species.

587. Thompson, M. M., P. Romisondo, E. Germain, R. Vidal-Barraquer, and J. Tasiás Valls. An evaluation system for filberts (Corylus avellana L.). HortSci. 13(5):514-517.--A common evaluation system for filberts has been developed by research leaders of breeding programs in U.S., France, Italy, and Spain. The system incorporates important horticultural or economic traits and is independent of specific breeding objectives. To minimize the influence of site and season on certain traits, especially phenological traits, a standard set of well-known cultivars was established, against which all other clones are compared. Ratings are recorded numerically so the data can be readily computerized.
588. Thompson, M. M. Filbert Breeding--1979 update. Proc. Nut Grower's Soc. Oregon, Wash., and B.C. 64:52-55.--The accomplishments in the filbert breeding program for the past 10 years are summarized. Many selections are now available which are outstanding for traits desired in new varieties. Using these as parents is resulting in much improved progenies. Emphasis is being placed on high quality kernels, high percent kernel and trees with high yield efficiency. Blanching potential is being evaluated and clones whose skin is easily removed are used in further breeding to upgrade this character.
589. Thompson, M. M., D. G. Richardson. 1978. Is there an effect of pollenizers on filbert quality. Proc. Nut Grower's Soc. Oregon, Wash., and B.C. 63:52-58.--Filbert cultivars with high and low values for oil, linoleic acid, protein, starch, and sugar were used as pollen parents in controlled crosses on 'Barcelona'. Analyses (for these nutritional components) of the resultant seeds demonstrated that there was no genetic contribution of the male parent to seed composition.
590. Tvergyak, P. J. and D. G. Richardson. 1979. Diurnal changes of leaf and fruit water potentials of sweet cherries during the harvest period. HortSci. 14(4):520-521.--Diurnal leaf and fruit water potentials (Ψ) of sweet cherry (Prunus avium L.) showed that fruit pedicel Ψ was always lower at 6 AM than leaf Ψ but leaf Ψ was usually lower during the day. Varietal differences in Ψ occur but fruit maturity does not appear to have an effect. Minimum fruit pedicel Ψ was reached at about 2 PM and then recovered to the earlier higher Ψ as water uptake occurred during the night.
591. Richardson, D. G. and P. B. Lombard. 1979. Cork spot of Anjou pear: control by calcium sprays. Comm. in soil sci. and plant analysis. 10 (1&2):383-389.--Cork spot of pear (Pyrus communis L. cv. 'd'Anjou') fruits was reduced 20% to 80% with orchard applications of calcium at rates ranging from 325 to 3250 ppm as the chloride or nitrate sprays containing surfactant. Late season sprays were more effective than early season sprays and a series of sprays more effective than single sprays, although control of the disorder is seldom complete. Fruit calcium sprays increased fruit calcium concentrations by 15-30%, sufficient to decrease the incidence of the disorder. Boron concentrations have not been found to be associated with this disorder. Orchards exhibiting cork-spot incidences greater than 25-30% at harvest may have over-riding conditions rendering calcium sprays much less effective.

592. Raese, J. T. and C. F. Pierson. 1979. Alfalfa greening of 'Anjou' pear. HortSci. 14(3):232-234.--Alfalfa greening, (green stain, green mottle, or superficial cork) is a physiological disorder of 'Anjou' pear fruit, Pyrus communis L. This disorder is characterized by green streaks, blotches, and specks on the skin occurring most frequently at the stem end; it may also extend to the calyx end where superficial cork is also frequently present. Mineral analysis of the peel and the whole fruit of alfalfa greening-affected fruit indicated that the disorder was associated with higher nitrogen, potassium, and phosphorus content but lower calcium levels than normal fruit.
593. Richardson, D. G. and M. M. Thompson. 1979. Total lipid, protein, starch, sugar and fatty acid kernel composition of 39 filbert (Corylus avellana L.) clones. J. Amer. Oil Chemists' Soc. 56:198-199.--Filbert kernels (Corylus avellana L.) of 39 breeding clones were analyzed for total lipid, protein, starch, free sugars, moisture, insoluble residue, and fatty acid composition. Total lipid ranged from 54 to 68%, protein (11.5 to 20%), starch (0.2 to 6.9%), sugars (4 to 13%), and moisture (2.2 to 4.3%). The predominant fatty acids were oleic (69 to 80%), linoleic (12 to 24%), palmitic (3.7 to 7.3%), stearic (0.4 to 2.8%), and linolenic (trace to 1.5%). Insoluble residue ranged from 8 to 13%. The relationship of these factors to nut quality will be discussed.
594. Lombard, P. and J. Strang. 1978. Thinning Seckel pears for best returns. Proc. Ore. Hort. Sci. 69:56-57.--Hand thinning of Seckel pears increased fruit sizes at harvest at 30 leaves per fruit but crop losses amounted to 65%. Chemical thinning of bloom with GA₃ at 5 to 15 ppm increased fruit sizes without significant loss in crop level on standard and hedgerow Seckel pear trees.
595. Lombard, P. and A. E. Richardson. 1979. Physical principles involved in controlling phenological development. In ASAE Monograph "Modification of the aerial environment of crops." 429-440pp.--This is a review of studies on the effect of environment on phenological development of principally tree crops. A discussion follows on the effect of air temperature on buds and flower temperature. Temperature effects on chilling requirements, the concept of chill unit model, energy units - heat units for growing degrees hour concept, phenological responses to light, and the energy unit application.
596. Collins, M. D., P. B. Lombard and J. W. Wolfe. 1978. The effects of evaporative cooling for bloom delay on 'Bartlett' and 'Bosc' pear fruit maturity and quality. J. Amer. Soc. Hort. Sci. 103(2):187-189.--Mature orchard misting and sprinkling and young hedgerow misting for bloom delay of pear (Pyrus communis L.) reduced fruit sizes of 'Bartlett' 6% and of 'Bosc' 12%. Harvest maturity, indicated by fruit pressure testing, was delayed 0 to 6 days for 'Bartlett' and 2 to 7 days for 'Bosc'. The effect of bloom delay on fruit size and maturity was greater on 'Bosc' than 'Bartlett'. Bloom delay had a greater effect on fruit sizing at harvest (3.5 days for every 6 days of bloom delay) than on harvest maturity (1 day for every 6 days delay). Soluble solids, not affected in pears from the mature plots, were slightly lower in the misted hedgerow. Titratable acids were not influenced by bloom delay.

597. Collins, M. D., P. B. Lombard and J. W. Wolfe. 1978. Effects of evaporative cooling for bloom delay on 'Bartlett' and 'Bosc' pear tree performance. J. Amer. Soc. Hort. Sci. 103(2):185-187.--Two mist systems, one in a mature orchard and the other in a young hedgerow, delayed bloom 15 days for 'Bartlett' and 8 days for 'Bosc' pear (Pyrus communis L.), while a low pressure sprinkler system delayed bloom for 14 days for 'Bartlett' and 8 days for 'Bosc' in 1976. Bloom delay generally increased fruit set and seed content of the fruit. Return bloom was greatly reduced in the mature orchard 'Bartlett' mist and 'Bosc' sprinkler plots in 1976 and, in turn, cropping was reduced the following year on these plots. Yield during treatment years was generally lower in the delayed areas. Fruit growth rates were accelerated in the bloom-delayed trees, but total fruit volume was less than the non-delayed fruit. Leaf nitrogen levels were reduced in all bud delayed treatments. Pear psylla oviposition was delayed in the mist system. Fire blight, caused by Erwinia amylovora (Burr.) Winslow et al., absent in 1975, was found in the misted 'Bosc' and in the sprinkled plots of both cultivars in 1976.
598. Callan, N. W. and P. B. Lombard. 1978. Pollination effects of fruit and seed development in 'Comice' pear. J. Amer. Soc. Hort. Sci. 103(4):496-500.--Cross-pollination increased fruit set, fruit size and seed content of 'Comice' pear (Pyrus communis L.) in 3 large orchards without pollinizers. Supplemental self-pollination was equivalent to open pollination in its effect on fruit set and size. Low female fertility of 'Comice' could not be accounted for by early ovule degeneration or frost injury. Pollen transfer by bees was observed to be low in 2 orchards, with 36 and 41% of seedless fruit the result of open pollination. In comparison, only 6% of open-pollinated fruit were seedless in the orchard of greatest bee activity. Seedlessness was due to seed abortion during early fruit development. Classification of aborted seeds as to size at time of abortion revealed that in most fruits in minimal amount of seed growth occurs, although fruit retention does not require the presence of fully developed seeds. Fruit size was positively correlated with seed content, although this relationship was less pronounced in fruits with high seed count. The importance of seed development before abortion and of fully developed seeds in fruit set as well as fruit size is shown.
599. Bates, E. and P. Lombard. 1978. Evaluation of temperature inversions and wind machine on frost protection in southern Oregon. Ore. Agric. Exp. Sta. Special Report No. 514:1-22.--On nights with radiation frost, a wind machine kept temperatures high enough to protect about eight acres and gave partial protection over 11.5 acres. This also was true where the wind machine was used in combination with return stack heaters when air outside the orchard was reported at 23°F. Air temperature inversion of 3.33°F over the Bear Creek Valley area can be expected in the spring. Air temperature in the orchard can be raised about 1/2 the inversion value with mixing provided by a 90 HP wind machine. Therefore, a combination of some heaters and wind machine would be used when protection of 2°F or more is necessary

600. Bates, E. M. and W. Calhoun Jr. 1978. Local climatological data for Oregon State University 1977. OSU Special Report 277, 12pp.--Miscellaneous Paper 105, Agricultural Experiment Station, Oregon State University, "A Summary of Climate and Weather for Corvallis, Oregon, 1899 through 1960" by Wheeler Calhoun was published in March, 1961. The United States Department of Commerce National Weather Service, working with the Crop Science Department at Oregon State University, has instrumented the Hyslop Field Laboratory Weather Station to measure additional elements important to agricultural scientists. See Special Report 400, Agricultural Experiment Station, OSU, "Hyslop Farm Microstation Climate Summary," by P. D. Olson and Earl M. Bates, published in December, 1973, for additional climatic data. There will be a continuing need for a publication to make these data readily available to researchers. It is planned that local climatological data from Hyslop Field Laboratory Weather Station will be published annually.
601. Bates, E. 1979. Climatology can improve agri-weather advice. National Weather Digest Agriculture. 4(4):53-55.--Protecting crops, especially tree fruits, is becoming prohibitively costly. Climatological evidence shows that the period of frost protection action at Medford, Oregon could be shortened. For the producer willing to take some risk, the vulnerable period of the Bartlett pear, in relation to Medford's climate, is about March 31 to May 1. Detailed spring climate-fruit relationship studies need to be made for various fruits and their production areas.
602. Westwood, M. N. 1978. Temperate-zone pomology. New in Horticulture. --This book explains sound horticultural practices of importance to the growing of fruit and nut crops as well as the physiological principles on which those practices are based. Chapters are organized by subject rather than by crop, but a comprehensive index permits ready access to specific information about any particular fruit or nut species. Information on woody-plant propagation and the establishment of new planting is included, along with chapters on climatic areas or production, environmental requirements, and the botanical and genetic relationships of important orchard and small-fruit species. Several chapters deal with the seasonal sequence of events, while other chapters discuss in detail the cultural factors relating to soils, irrigation, plant nutrition, pruning, hormones and growth regulators, insects and diseases, and plant efficiency in high-density plantings.
603. Westwood, M. N., P. B. Lombard, W. M. Mellenthin, C. J. Weiser et al. 1978. Phenology and plant species adaptation to climates of the Western United States. Ag. Exp. Sta. Bul. 632. 15 pp.--The phenology and general hardiness of fruit cultivars and phenospecies were studied at 10 climatic sites in the Western Region and one in Minnesota during five years. Survival of several Pyrus species was related both to inherent hardiness and to the degree of chlorosis sustained in soils with high pH. P. pashia and P. fauriei were most susceptible to chlorosis and P. amygdaliformis and P. elaeagrifolia were the most tolerant of high pH soils. P. ussuriensis, P. fauriei and P. communis were hardiest, while P. pashia and P. amygdaliformis were least hardy. The bloom periods of most species

were most protracted in marine climates and in lower latitudes, relative to continental sites. In the former case such protraction was due to cool spring temperatures, and in the latter it probably was due to sub-optimal winter chilling. The implications of the data in fruit growing and in the continuing search for better predictive phenologic models are discussed.

604. Westwood, M. N. and H. O. Bjornstad. 1978. Winter rainfall reduce rest period of apple and pear. *J. Amer. Soc. Hort. Sci.* 103(1):142-144.-- Repeated winter rain or water soaking in the laboratory reduced the time required for breaking winter rest of 'Bartlett' pear (*Pyrus communis* L.) and 'Starkrimson' apple (*Malus domestica* Borkh). Possibly a water soluble inhibitor is leached from the buds.
605. Westwood, M. N. 1978. Mahaleb x mazzard hybrid cherry stocks. *Fruit Var. Jour.* 32(2):39.--About two dozen *Prunus mahaleb* x *P. avium* (Mazzard) (M x M) clonal rootstocks have been tested for sweet cherry in Oregon by R. L. Stebbins and the author since 1965. Results have varied considerably from plot to plot. Only clone 14 is as dwarfing as Stockton Morello stock, while clones 3, 39, and OCR-2 result in moderate growth control. Other M x M clones appeared about as vigorous as Mazzard controls. Flowering and fruiting varied considerably with the different rootstocks. Yield efficiency was best with clones 2, 39, 46, 49, 54, 88, and OCR-2. Efficiency was good on Mazzard, Stockton Morello, and M x M clone 14. When used as trunkstocks, the M x M clones appear not to be injured severely by bacterial canker (*Pseudomonas* spp.). Mineral nutrient uptake varied somewhat among the M x M clones, but in most cases, did not affect general performance (Table 1).
606. Westwood, M. N. and G. Stevens. 1979. Factors influencing cherry and prune set. *Proc. Oregon Hort. Soc.* 70:175-179.--Two primary factors affecting fruit set are bloom density and tree health. No set is possible if there is no bloom. Likewise set is poor if the trees are diseased, infested with pests, or suffer from mineral nutrient deficiencies. A desirable set on trees with a heavy bloom is related to the natural size of the fruit. The larger the mature fruit, the lower the percentage set needed for a full crop. Thus sour cherry needs 40 to 75% set, sweet cherry 35 to 60%, and Italian prune 15 to 20%. Sweet cherries are self sterile, so a full set is more difficult to achieve than with sour cherries and prunes that are self fertile. The primary factors affecting fruit set are: (1) Variety - The genetic tendency to light or heavy set. (2) Rootstock - Effect on hormonal balance. (3) Mineral nutrition - Levels of essential elements. (4) Weather - Rain, wind, temperature. (5) Pollination - Pollinizers and pollinator bees. (6) Diseases and pests - Degree of control. (7) Pruning - Degree and type. (8) Growth regulators - Kind and timing.
607. Westwood, M. N. and J. S. Challice. 1978. Morphology and surface topography of pollen and anthers of *Pyrus* species. *J. Amer. Soc. Hort. Sci.* 103(1):28-37.--A survey of 18 pear species using the scanning electron microscope showed considerable variability in the size, shape and surface

topography of both anthers and pollen grains. The size, shape and surface topography of anther cells did not vary directly with the size, shape and topography of pollen from the same species. The degree of similarity of individual features among species did not seem to coincide with their geographic distribution. However, the combination of pollen and anther features was unique for each species, indicating their value for taxonomic identification.

608. Westwood, M. N. and H. R. Cameron. 1978. Environment-induced remission of pear decline symptoms. *Plant Disease Reporter*. 62(2):176-178.--Remission of pear decline symptoms was studied on trees in the absence of the vector, compared with similar trees in which the vector was present each season. 'Bartlett' pear trees (*Pyrus communis*) budded on pear decline-susceptible *P. pyrifolia* roots were exposed to natural infection by pear decline-infected psylla (*Psylla pyricola*) for two years at Corvallis, Oregon, after which 24 of the exposed trees showing pear decline symptoms were moved to two psylla-free locations in Colorado, and 32 trees were kept at Corvallis. All trees grown under Colorado conditions for 2 years became entirely free of pear decline symptoms, whereas 36% of the trees grown at Corvallis were dead and an additional 46% exhibited severe pear decline symptoms. Mycoplasma-like bodies were present in the leaf phloem of declining trees, kept at Corvallis, but could not be found in phloem from five trees grown in Colorado. We concluded that symptom remission can occur during some dormant seasons and that reinfection by the psylla vector may be necessary for the disease to continue.
609. Westwood, M. N. 1978. Chemical thinning and growth regulators on apples and pears. *Proc. Utah State Hort. Soc.* 19-30pp.--The effects of chemical thinning on next year's crop are discussed. A key benefit of chemical thinning is that return bloom is increased, which minimizes alternate bearing. The use of GA early in the season to increase fruit length also will inhibit floral initiation for next year's crop, while use of Alar increases flowering.
610. Westwood, M. N. 1978. Rootstocks on stone fruits. *Proc. Utah State Hort. Soc.* 35-48pp.--The general characteristics of rootstocks are outlined, including dwarfing, mineral nutrient uptake, yield efficiency, pest resistance, disease resistance, tolerance to different soils, and correct spacing.
611. Westwood, M. N. and H. O. Bjornstad. 1980. Mineral nutrient content of leaves of several apple (*Malus*) species. *Compact Fruit Tree*. Vol 13 5pp.--*Malus* species are indigenous to Europe, Asia Minor, Asia and North America. Most of the rootstocks used in North America, however, are derived from domestic cultivars or from *Malus sylvestris* Mill. the European wild apple. While such stocks have provided considerable diversity, e.g. in dwarfing, precocity and pest resistance, the wealth of worldwide genetic material of *Malus* in general has not been used to its potential in solving certain persistent problems related to rootstocks. One such problem is that of providing the tree with essential mineral nutrients under a variety of soil and climatic conditions. The present study was

done to determine differences in nutrient element content of species from Europe, Asia and North America grown at the same site. Such a study indicates solutions to problems of both deficiency and excess for specific elements.

612. Anderson, A. R. and L. W. Moore. 1978. Host specificity in the genus Agrobacterium. Etiology. 69:320-323.--One hundred seventy-six Agrobacterium strains, principally from the USA and isolated from 26 host species in 11 plant families, were inoculated on 11 known crown gall hosts to determine host specificities. No strain was pathogenic on all hosts tested. Sixty-six percent of the pathogenic strains induced tumors or hairy root on six to eight of 11 host species tested. Twenty-seven strains (nonpathogenic on the initial 11 host species) were nonpathogenic on three additional host species. Three percent of the pathogens infected only the host species from which they were originally isolated, which suggests that host origin has a minimal influence on a strain's host range. In some instances, strains isolated from the same naturally occurring tumor infected different host species, but some strains failed to infect the host of origin. Agrobacterium rubi strains were indistinguishable from A. tumefaciens strains on the basis of pathogenicity, and five of eight A. rhizogenes strains formed tumors on some plants and hairy root on carrot. Tomato and Datura stramonium were infected by a greater number of pathogenic agrobacteria (81% each) than any other host species tested. However, all strains that infected tomato did not infect Datura and vice versa. These data corroborate that speciation based on pathogenicity and host specificity is of little taxonomic or practical value.
613. Moore, L. G. Warren and G. Strobel. 1978. Involvement of a plasmid in the hairy root disease of plants caused by Agrobacterium rhizogenes. Plasmid 2, 617-626.--Agrobacterium rhizogenes causes a proliferation of roots on plants that it infects. This is in contrast to Agrobacterium tumefaciens which causes gall or tumor formation on its hosts. A large molecular weight plasmid (1.1×10^8) in A. rhizogenes strain A₄ is correlated with the infectivity of this organism. However, this plasmid apparently carries additional information not vital to the infection process. Experimental evidence supporting these conclusions is: (i) A. rhizogenes A₄ loses infectivity when all or part of the plasmid is lost after treatment with ethidium bromide or after heating at 37°C. (ii) There occurs successful conjugational transfer of the A₄ plasmid in planta to a noninfectious, antibiotic-resistant A. radiobacter. Infectious transconjugants were antibiotic resistant and contain a plasmid comparable to that of A. rhizogenes A₄. (iii) A. rhizogenes A₄ and the transconjugants possessed identical Eco RI restriction endonuclease patterns, whereas three ethidium bromide-treated isolates that were noninfectious but plasmid containing had lost or gained bands in the pattern. The infectious plasmid of A. rhizogenes A₄ has been designated pHR_{A4}. Some potential benefits of the A. rhizogenes plasmid to agriculture are discussed.
614. Montoya, A. L., Moore, L. W., Gordon, M. P. and E. W. Nester. 1978. Multiple genes coding for octopine-degrading enzymes in Agrobacterium.

Jour. Bacteriology. 136(4):909-915.--Most biotype 2 strains of Agrobacterium tumefaciens and A. radiobacter which utilize nopaline also degrade octopine. In all such strains studied, the ability to degrade octopine did not appear to be transferred to plasmidless recipient cells under conditions of plasmid transfer in which the ability to utilize nopaline was transferred. An octopine-degrading mutant was isolated in a strain cured of its plasmid, suggesting that genes of octopine degradation may have a chromosomal location in some strains. In strains in which octopine utilization is coded by plasmid genes, octopine degradation was always inducible, whereas in strains which degrade both octopine and nopaline, octopine utilization was constitutive although nopaline degradation was inducible. When plasmids coding for octopine-utilizing ability were transformed into a strain containing either a nopaline- or null-type plasmid, transformants able to degrade octopine were either not observed or were unstable upon purification. All of these data suggest that plasmids associated with virulence are incompatible with one another, and therefore imply that the major groups of plasmids associated with virulence have a common origin.

615. Moore, L. W., G. Warren and G. Strobel. 1978. Plasmid involvement in the hairy root infection caused by Agrobacterium rhizogenes. Proc. 4th Int. Conf. Plant. Path. Bact. 127-131 pp.--Isolation of a bacteria-free compound from a liquid culture of Agrobacterium rhizogenes (strain A₄) capable of inducing roots on carrot slices was unsuccessful. Living, virulent bacteria were always necessary. Strain A₄ inoculated upon Nucleopore filter membranes (0.2 μ pore size) resting on carrot slices grew profusely, but induced no roots on the carrot slices. Subsequently, a large molecular weight plasmid (1.23 x 10⁸ daltons) was isolated from the A₄ strain. However, large molecular weight plasmids commonly are present in Agrobacterium species for which no biological function has been defined. We cultured (liquid) strain A₄ in the presence of 25, 50, 100, and 200 μ molar ethidium bromide. Single colonies from these cultures were cloned 2-3 times and inoculated to carrots. Some clones were no longer virulent, and no plasmid could be detected in two of the clones. A Kerr-cross was performed on carrot slices using strain A₄ as a donor. An avirulent strain, N1, resistant to 100 μg/ml each of chloramphenicol and rifampicin and 20 μg/ml of tetracycline was used to 100 μg/ml each of chloramphenicol and rifampicin and 20 μg/ml of tetracycline was used as the recipient. Only three out of 90 cloned potential transconjugants were virulent on carrot slices. Each transconjugant was resistant to all three antibiotics, possessed a plasmid with a molecular weight ca: 9 x 10⁷ daltons, and were sensitive to agrocin 84. Except for antibiotic resistance, these characteristics are all common to the donor strain. Thus, the plasmid (Hr) present in A. rhizogenes strain A₄ codes for hairy root induction and has some resemblance to the Ti plasmid responsible for oncogenicity in A. tumefaciens. These data suggest that the Hr plasmid could be employed to genetically engineer drought tolerance in certain plant species.

616. Moore, L. W. and G. Warren. 1979. Agrobacterium radiobacter strain 84 and biological control of crown gall. Ann. Rev. Phytopathol. 17:163-79.

--No abstract submitted.

617. Moore, L. W. 1979. Practical use and success of Agrobacterium radiobacter strain 84 for crown gall control. Soil-borne Plant Pathogens. 686 pp.--Agrobacterium radiobacter strain 84 has been remarkably effective for controlling crown gall disease in some countries, but ineffective in parts of other countries. These antagonistic bacteria have been applied commercially (10^6 - 10^7 colony-forming units/ml) to seeds, bare rooted plants, graft unions, and cuttings. The bacteria are distributed on solid nutrient agar, in aqueous cell suspensions, or in a peat formation. Half-life of these cells is several months at 4°C. If the treated plants are harvested, any fresh wounds should receive a new application of the antagonist. Application of strain 84 to roots colonized, but uninfected, by a sensitive strain of A. tumefaciens can prevent infection; latent infections are not inhibited. Strain 84 apparently inhibits infection by producing an extracellular molecule (agrocin 84), coded for by plasmid genes, which inactivates sensitive strains of the pathogen. Dead cells of strain 84 are ineffective but a cell-free fraction from culture filtrates of strain 84 has prevented infection. A. tumefaciens strains insensitive to agrocin 84 in vitro usually have infected plants treated with strain 84 in field trials, but surprisingly, some hosts were protected. The prevention of crown gall by A. radiobacter strain 84 is one of the most successful examples of biological disease control in plant pathology and other antagonists will undoubtedly be found that are active against pathogens insensitive to strain 84.
618. Moore, L. W. 1979. Factors affecting the mode of Agrobacterium radiobacter 84 in controlling crown gall. Fruit South. 4(1):11-13.--An article in the July issue of Fruit South summarized our field studies of biological control of crown gall using Agrobacterium radiobacter strain 84. The present report will review pertinent literature and summarize work from our lab about the mechanism(s) by which strain 84 inhibits crown gall development. Antibiotic production against the pathogen by Agrobacterium radiobacter strain 84 was suspected initially as the mechanism of biological control. When a culture of strain 84 is spotted in the center of an agar medium in a Petri dish, the growing bacteria release an antibiotic into the agar medium. After 3-4 days' growth, a test strain is inoculated over the surface of the agar medium. If the test strain is sensitive to the antibiotic produced by strain 84, no bacterial growth is observed around the producing colony (Fig. 1). The diameter of this circular zone of inhibition varies with the strain being tested, the kind of growth media used, length of time strain 84 is grown before challenging with a test strain, etc.
619. Moore, L. W. 1979. Comparison and discussion of biocontrol of crown gall results in the Pacific Northwest, Pennsylvania, and South Carolina. 4(1): 4-7.--No abstract submitted.
620. Moore, L. W. 1979. Biological control of crown gall in the Pacific Northwest using Agrobacterium radiobacter strain 84. Fruit South. 3(5): 28-30.--Control of crown gall by strain 84 is one of the most remarkably

successful examples of biological control in plant pathology. The pioneering work of Dr. A. Kerr of Australia deserves much of the credit for this success. There also are some examples of ineffective biocontrol by strain 84, some of which I've discussed, and others may yet be found. However, the phenomenon of crown gall biocontrol has been documented well, and other systems hopefully will be found to supplant failures by strain 84. Growers starting to use strain 84 for the first time should always leave some plants untreated for a control to compare the effectiveness of the bioantagonist. Use of the bioantagonist should never supplant, but should enhance sound nursery practices such as sanitation and mangement.

621. Florance, E. R. and H. R. Cameron. 1978. Three-dimensional structure and morphology of mycoplasma-like bodies associated with albino disease of Prunus avium. Phytopath. 68:75-80.--Mycoplasma-like bodies were found in association with albino disease of Prunus avium L. The bodies were present in mature sieve tube elements of diseased tissue but not in healthy controls. The bodies ranged from 0.15 to 1.0 μm in diameter and 0.5 to 1.8 μm in length. Morphologically the bodies were spherical or tubular. Some of the tubular bodies were branched, and some bodies were attached to stacked endoplasmic reticulum.
622. Spotts, R. A. 1979. Infection of grape by Guignardia Bidwellii - Factors affecting lesion development, conidial dispersal, and conidial populations of leaves. Phytopathology. Vol. 69. p. 920.--Experiments were conducted to evaluate the effects of temperature and relative humidity on time of incubation and pycnidia formation of Guignardia bidwellii on grape leaves and to study factors affecting conidial release and adherence to and populations on leaf surfaces. Incubation was approximately 1 wk at 21C and 26.5C, and 2 wk at 15C. After lesions appeared, nycnidia formed within 3 to 5.5 days at 21C and 15C respectively. Rainfall duration of 1 to 3 hrs provided optimum conidia dispersal. Conidia were readily washed from inoculated leaves, unless 60 min or longer dryness preceded washing. Quantative relationships were established between inoculum concentration, conidial concentration on leaves, and disease severity. Conidial populations on leaves in the vineyard were closely related to dispersal and retention conditions as well as disease severity.

623. Spotts, R. A. and D. C. Ferree. 1979. Effect of a dormant application of surfactants on bud development and disease control in selected deciduous fruit plants. HortSci. 14(1):38-39.--Spray treatment a single dormant application of high concentrations of anionic (Triton CS7) and nonionic (Triton N57 and Triton X100) surfactants caused up to 5 days delay in bud break in apple (Malus domestica Borkh.), but had less effect on grape (Vitis spp.) and peach (Prunus persica (L.) Batsch) and none on pear (Pyrus spp.). Surfactants tended to extend the bud break but were frequently lethal to buds, particularly at concentrations of 3% and 5% active ingredient. In field studies, surfactants delayed the early stages of flower bud development but not bloom of apple or peach and did not control apple scab caused by Venturia inaequalis (Cke.) wint. or powdery mildew caused by Podosphaera leucotricha (Ell & Ev.) Salm.
624. Spotts, R. A. 1979. Use of bay med 6447 for eradication of grape black rot caused by guignardia bidwellii. Plant Disease Reporter. 63(11):967-969.--The experimental fungicide 1-(4-chlorophenoxy)-3, 3-dimethyl-1-(1H-1, 2, 4-triazol-1-yl)-2-butanone (Bay Meb 6447) used in a post-infection control program was compared with a standard (zinc ion-maneb complex) protectant fungicide program. Disease control, yield, cluster weight, soluble solids, and phytotoxicity of 'Aurore' grapes were evaluated during two seasons. The Bay Meb 6447 program required three (in 1977) and two (in 1978) fewer applications than the zinc ion-maneb complex program, and provided excellent foliar and fruit rot control. Bay Meb 6447 treatment reduced cluster weight, but did not affect yield or soluble solids when compared with the standard fungicide program. Bay Meb 6447 caused severe foliar stunting and deformation to grape plants in growth chambers, but phytotoxicity was not severe in the vineyard.
625. Spotts, R. A. and D. C. Ferree. 1979. Effect of overtree misting for misting for bloom delay on Venturia inaequalis ascospore maturity and release. Plant Dis. Repr. 63:108-112.--The effect of misting on Venturia inaequalis ascospore maturity and release was studied in an orchard of 8-year-old 'Golden Delicious' apple trees, water-misted to delay bloom for frost protection. Low incidence of scab on misted trees was attributed to decreased inoculum potential resulting from: i) release of ascospores while misted trees were still dormant, and ii) leaf surface water film of sufficient thickness to interfere with ascospore release. Diminished ascospore discharge related to extended leaf wetness periods may also relate to decreased inoculum in the orchard. Under these conditions, standard fungicide programs provided excellent apple scab control.
626. Spotts, R. A. and D. C. Ferree. 1979. Photosynthesis, transpiration, and water potential of apple leaves infected by Venturia inaequalis. Phytopathology. 69:717-719.--Experiments were conducted with attached McIntosh and Delicious apple leaves to evaluate the effects of Venturia inaequalis infection on photosynthesis, transpiration, and water potential. Scab infection caused significant reduction of photosynthesis in Delicious leaves 14 days after inoculation and in Delicious and McIntosh leaves 28 days after. Percentage of total leaf area diseased exceeded percentage reduction of photosynthesis for both cultivars. Reduced CO₂

assimilation was detected in scab-infected leaves only after visible symptoms had appeared. Scab infection did not affect transpiration of apple leaves but caused a decrease in water potential of McIntosh leaves.

627. Zwick, R. W. and P. H. Westigard. 1978. Prebloom petroleum oil applications for delaying pear psylla (homoptera: psyllidae) oviposition. The Canadian Entomologist. 110(3):225-236.--Application of petroleum oils prior to oviposition by overwintering pear psylla, Psylla pyricola Foerster, reduced oviposition by 98% for up to 5 weeks. The delay of oviposition and reduction in subsequent egg and nymph densities were inversely proportional to the rate of oil used. The reduced oviposition rate was due primarily to inhibition of oviposition by oil deposits on the host, not adult mortality. No commercially important deleterious effects of oil treatments were detected on several pear varieties.
628. Zwick, R. W. and G. J. Fields. 1978. Field and laboratory evaluations of fenvalerate against several insect and mite pests of apple and pear in Oregon. J. Econ. Entomol. 71:793-796.--The synthetic pyrethroid fenvalerate was laboratory and field tested against several insect and mite pests of pome fruit crops in Oregon. This chemical gave superior pre-, and postbloom control of pear psylla, Psylla pyricola Foerster, adults nymphs at rates of ca. 0.4kg AI/ha when compared to a number of other experimental and registered insecticides in seasonal programs. Fenvalerate was also effective against codling moth, Laspeyresia pomonella (L.), on apples, had little effect on apple rust mite, Aculus schlectendale (Nalepa), was destructive to the predatory phytoseid Typhlodromus pryi Scheuten, and was found to cause resurgences in densities of the European red mite, Panonychus ulmi (Koch).
629. Fields, G. J. and R. W. Zwick. 1978. Control of thrips on apples in the Hood River Valley of Oregon. Ag. Exp. Sta. Bul. 668. 18pp.--Field tests for 11 years have indicated damage to apples by Western flower thrips can be reduced as much as 90 percent by a well-timed application of an effective insecticide. Formetanate, (Carzol^R), applied at or near full bloom, was the most effective insecticide tested in preventing pansy spotting on Newtown, and pitting and marking on Golden Delicious fruit. Pre- and post-bloom applications were ineffective in preventing apple injury regardless of the insecticide used. A full-bloom application of formetanate was safe to honeybee pollinators if the spray was allowed to dry at least three hours before bees began to forage. Trapping thrips in orchards to determine if preventive sprays were necessary proved unreliable.
630. Rice, R. E., S. C. Hoyt and P. H. Westigard. 1979. Chemical control of male San Jose scale (homoptera: Diaspididae) in apples, pears, and peaches. Can. Ent. 111:827-831.--Chemical treatments to kill male San Jose scale, Quadraspidiotus perniciosus (Comstock), were applied to apples, pears, and peaches in Washington, Oregon, and California respectively. Dilute sprays of diazinon applied just prior to or at first emergence of overwintered males and 7 or 14 days thereafter were compared with normal sprays directed against scale crawlers. In all instances, treatments for male scale gave control equal to that provided by a single spray tim-

ed to control first generation crawlers. Although the male sprays were effective, they do not fit well into current pest management programs. Complications with the male sprays included timing that coincided with petal fall on earlier varieties or full bloom on later varieties with potential for kill of pollinators; possible disruption of adult predators stressed by overwintering, and russetting of Golden Delicious apples from immediate post-bloom sprays. In all three crops, post-bloom male sprays would also be an added seasonal treatment. Current practices utilize pre-bloom sprays, or combine scale crawler control with sprays for codling moth, Laspeyresia pomonella (L.), peach twig borer, Anarsia lineatella Zeller, and/or mites in June.

631. Hoyt, S. C., P. H. Westigard and E. C. Burts. 1978. Effects of two synthetic pyrethroids on the codling moth, pear psylla, and various mite species in Northwest apple and pear orchards. Entomol. Soc. Amer. 431-434pp.--The synthetic pyrethroid permethrin sprayed at rates ranging from 2-6 g AI/100 liters gave commercial control of the codling moth, Laspeyresia pomonella (L.) on pears. Permethrin and fenvalerate were somewhat acaricidal in their effects, particularly at high dosages (18 g AI/100 liters) but these effects were of short duration. More commonly, dramatic increases in populations of Tetranychus urticae Koch, T. mcdanieli McGregor, or Panonychus ulmi (Koch) followed use of these compounds. These synthetic pyrethroids were highly toxic to Metaseiulus occidentalis (Nesbitt), an important predator of spider mites. Rates as low as 3 g AI/100 liters also were effective on overwintering pear psylla, Psylla pyricola Foerster adults, but higher rates (6 g AI/100 liters) were required to obtain control of summer psylla populations.
632. Moffitt, H. R., P. H. Westigard and D. O. Hathaway. 1979. Pheromonal control of the codling moth and biological control of the pear psylla. Proc. Ore. Hort. Soc. Vol. 70:95-96.--Codling moth sex pheromone in Conrell fibers was applied to 3 pear orchards in southern Oregon for mating inhibition. Four or five applications of pheromone provided substantial lowering of male catches in pheromone traps and reduced codling moth infestation in fruit by over 90% in situations of low to moderate native moth populations. Little or no control was achieved in an orchard with high densities of native moths. Pear psylla populations were reduced by natural enemies in the pheromone treated plots.
633. Westigard, P. H. and R. W. Zwick. 1979. Pear psylla control: current status and future potentials. Proc. Ore. Hort. Soc. Vol. 70:91-94. The potential and problems associated with the use of various control tactics in the economic suppression of pear psylla are discussed. The tactics include: chemical control (emphasis is given to the pyrethroid insecticides); biological control; host plant modification (including host masking and use of plant growth regulators) and cultural controls (overtree irrigation for damage suppression).
634. Westigard, P. H. 1979. Integrated pest management of insects and mites of pear. In "Pest Management for Deciduous Tree Fruits and Nuts". Plenum Press - New York and London. 151-202pp.--Progress toward the devel-

opment of an I P M program on pears in southern Oregon is reported. Major emphasis is given to major pear pests including the codling moth, spider mites, pear psylla, pear rust mite and San Jose scale. For each pest the status and potential of various control tactics is discussed including; host plant resistance, chemical control and biological control. Sampling techniques and economic injury levels for each pest are discussed. Economic and horticultural aspects of the I P M program on pears are considered.

635. Westigard, P. H., P. B. Lombard, D. W. Berry. 1979. Integrated pest management of insects and mites attacking pears in southern Oregon. Agric. Exp. Stn. Bulletin No. 634. 41pp.--Progress toward the development of an I P M program on pears in southern Oregon is reported. Major emphasis is given to major pear pests including the codling moth, spider mites, pear psylla, pear rust mite and San Jose scale. For each pest the status and potential of various control tactics is discussed including; host plant resistance, chemical control and biological control. Sampling techniques and economic injury levels for each pest are discussed. Economic and horticultural aspects of the I P M program on pears are considered.
636. AliNiazee, M. T. 1979. A computerized phenology model for predicting biological events of Rhagoletis indifferens (diptera: Tephritidae). Can. Ent. 111:1101-1109.--A phenology model based on a time-temperature relationship has been developed for the western cherry fruit fly, Rhagoletis indifferens Curran. The model predicts the occurrence of various biological events such as emergence levels, mating, oviposition, larval appearance, parasite activity, and pupation. These events are predicted as a function of summation of thermal units (TU) starting 1 March. For example, emergence begins at 462, oviposition at 541, hatch at 594, and pupation at 795 TU. The model was validated by actual field observations for a period of 3 years (1976-1978). Extended validation of first emergence was obtained from an entirely different cherry growing area, the Hood River Valley. The model could be a useful tool in integrated pest management program on cherries.
637. AliNiazee, M. T. and G. W. Krantz. 1978. Zur chemischen bekämpfung der haselknospen-milben (acari, eriophyoidea). Anz. Schädlingskde., Pflanzenschutz, Umweltschutz 51, 37-39pp.--Various chemicals were tested for control of the filbert bud mites Phytoptus avellanae Nalepa and Cecidophyopsis vermiformis (Nalepa) using a single treatment applied during mite migration. Efficacy was determined by counting mite-infested buds in the spring and fall. Endosulfan applied at 1.2 g/l was the most effective treatment. Dicofol, ethion and Plictran (tricyclohexylhydroxatin) gave moderate to poor control.
638. AliNiazee, M. T. 1978. The western cherry fruit fly, Rhagoletis indifferens (diptera: Tephritidae). Can. Ent. 110:1133-1139.--Attractant traps, such as Pherocon ICPY-MAGO trap and Pherocon-AM Standard trap, were effective in monitoring emergence of the western fruit fly, Rhagoletis indifferens Curran. Among the aerial traps tested. ICPY-MAGO, Pherocon-AM Standard, and Saturn yellow colored rectangles and spheres were equally

effective. The ammonium carbonate traps were significantly inferior. A management program that utilized aerial traps as monitoring devices reduced the amount of spraying from 20 to 100%, depending on the fly population in the orchard, and resulted in a substantial saving of spray costs.

639. Brown, R. D. and M. T. AliNiazee. 1978. Radiation biology of the western cherry fruit fly, Rhagoletis indifferens Curran (diptera: Tephritidae). Sonderdruck aus Bd. 85 H. 2, 123-132.--Irradiation of the western cherry fruit fly, Rhagoletis indifferens Curran, as adults and pupae induced sterility. A reduction in egg, hatch of about 99% occurred when males were irradiated with a dose of 8 krad and mated to normal females. Longevity of male flies decreased significantly with increasing doses of radiation. Adult females were more sensitive to radiation than males; they became infecund at 5 krad. However, the longevity of females was only slightly reduced by radiation of up to 16 krad. In laboratory cages, sterile males were more competitive in ratios of 4 : 1 than 8 : 1, the total number of matings was about the same with the larger number of males. Sterile males irradiated as adults mated only slightly less frequently than normal males in the same cages. Males irradiated as pupae were less than half as competitive as males irradiated as adults. Data indicate that R. indifferens is a good candidate for sterile insect release technique.
640. AliNiazee, M. T. 1974. Role of a predatory mite, Typhlodromus arboreus in biological control of spider mites on apple in western Oregon. Proc. 4th Int. Cong. Acarology. 637-642.--The yellow mite, Eotetranychus carpini borealis (Ewing), the European red mite, Panonychus ulmi (Koch), the two-spotted mite, Tetranychus urticae Koch and the McDaniel mite, Tetranychus mcdanieli McGregor, are among the commonly occurring spider mite species in apple orchards of the Willamette Valley of Oregon. Mixed populations of two or more of these species are mostly responsible for heavy damage to apple foliage. The yellow spider mite is apparently more troublesome than the others, although occurrence of high densities of the European red mite and two-spotted mite are not uncommon. The feasibility of managing spider mites on pome fruits by utilizing naturally occurring predatory mites has now been established in many areas of the United States including Washington (Hoyt, 1969), Oregon (Westigard, 1971), California (Croft and McMurtry, 1972), and Michigan (Croft and McGroatry, 1973). The most commonly utilized predator is a phytoseiid mite, Metaseiulus (Nesbitt), which has received much interest in recent years. In an attempt to understand the natural control of spider mites, initial surveys were started in September 1972 to determine the diversity of predatory fauna in apple orchards of Western Oregon. A phytoseiid mite, Typhlodromus arboreus Chant, was found in almost all orchards surveyed, in varying numbers. The significance of T. arboreus in the biological control of phytophagous mites is discussed in this paper.
641. AliNiazee, M. T. 1979. Mite populations on apple foliage in western Oregon. Rec. Ad. Acarology. 1:71-76.--The European red mite, Panonychus ulmi (Koch), and the yellow mite, Eotetranychus carpini borealis (Ewing) are the two most important mite pests of apples in the Willamette Valley

of Oregon. Although a number of other phytophagous mite species, such as the twospotted mite, Tetranychus urticae Koch, apple rust mite, Aculus schlectendali (Nalepa), and the McDaniel mite, Tetranychus mcdanieli McGregor, are commonly encountered in apple orchards, none are serious pests. The predatory mite, Typhlodromus occidentalis Nesbitt, is rarely seen in the apple orchards of the Willamette Valley, but another phytosiid mite, Typhlodromus arboreus Chant is very common and is an important factor in reducing populations of phytophagous mite species (AliNiasee, 1978). The studies reported here were initiated in 1973 to determine the long term effects of elimination of all insecticide and fungicide sprays from a block of apple trees on phytophagous and predatory mites.

642. Krantz, G. W. 1974. The role of Phytocoptella avellanae (nal.) and Cecidophyopsis vermiformis (nal.) (eriophyoidea) in big bud of filbert. Proc. 4th Int. Cong. Acarology. 201-208pp.--1. Cecidophyopsis vermiformis causes summer big bud in susceptible filbert varieties in western Oregon, while typical spring big bud is initiated by Phytocoptella avellanae. 2. Spring invasion of new axillary buds is accomplished by P. avellanae nymphs and C. vermiformis adults. Buds may be infested by one or both species. 3. C. vermiformis migrates from blaster summer big buds to the partially expanded medium buds dominated by P. avellanae. 4. Bud loss due to summer bud bud rarely exceeds 3 - 5%. Typical big bud caused by P. avellanae results in bud losses of 18-20% in observed orchards. 5. Occurrence of summer big bud may be related to initial occupation and colonization of core tissue by C. vermiformis in new axillaries following spring migration.
643. Lagerstedt, H. B. 1978. The fabulous filbert. HortSci. 13(2):122.--The cover story for the April 1978 issue of HortScience. This one page article provides a synopsis of the filbert, its uniqueness, its origins, additives and history. Filbert uses, growing areas, mechanization, problems, propagation, and areas of future research are also discussed.
644. Lagerstedt, H. B. 1978. Hardiness in filberts and walnuts. Annu. Rep. No. Growers Ass. 69:118-121.--A severe freeze in the southern half of Oregon's Willamette Valley during December 1972 served as a test of plant hardiness for walnut and filbert cultivars. Tree death or degree of injury could be related to both physical and biological factors. The physical factors were intensity and duration of cold, range of daily temperature fluctuation, topography, and the influences of snow and sun. The biological factors influencing freeze damage were: cultivar differences, degree of plant stress, stage of tissue development, tree age and vigor. Walnut cultivars that proved to be hardy are 'Spurgeon' and 'Broadview' plus 'Carpathian' and 'Manregian' seedlings. Two filbert cultivars, 'Butler' and 'Hall's Giant', exhibited superior hardiness.
645. Lagerstedt, H. B. 1978. Tree trunk applicators for sunscald protection. HortSci. 13(5):533-534.--The application of exterior white latex paint has proved useful in protecting young fruit and nut trees from summer sunscald. The common methods of paint application are by brush or spray, but brushing is time consuming and not always fully effective and spray-

ing is wasteful of paint and the equipment is difficult to clean. The construction and use of new application ideas such as edge rollers, shake paint applicators, and paint mittens are presented.

646. Kelley, J. R. and H. B. Lagerstedt. 1979. Screening plant growth regulators to improve filbert nut set progress report. Proc. Nut Growers Soc. Ore., Wash., & B.C. 64:44-51.--Several growth regulators were applied to filbert trees during April and May in an attempt to reduce the drop of developing nut clusters. Subsequent drop of clusters and vegetative terminals was monitored throughout the growing season. Percent set, number of nuts/cluster, kernel wt. and shoot growth were also evaluated. Gibberellic acid reduced set drastically, eliminated developing catkins, caused shoot elongation and the development of multiple flower clusters/node in the following year. Ethephon increased set in the late application only. TIBA reduced nut set and kernel wt. SADH has a slight tendency to increase the number of nuts/cluster.
647. Lagerstedt, H. B. 1979. New and old pesticides registered for use on filberts. Proc. Nut Growers Soc. Ore., Wash., & B.C. 64:56-60.--A review of old and addition of several new pesticides registered for use on filbert trees. Insecticides, fungicides, bacteriocides and herbicides are covered.
648. Lagerstedt, H. B. 1979. Tree kill trials with glyphosate and other herbicides. Proc. Western Soc. Weed Sci., Vol 32 pg. 100.--The effects of 2,4-D, Tordon 212, Maintain 125, Krenite, Roundup, Amitrol-T and Phytos applied by trunk injection to filbert and cherry trees is detailed. Effective tree kill was established by a lack of sucker growth in the following year. Roundup, 2,4,-D, Tordon 212 were effective. Treatments made from July to December were more efficient than those made in February. Close spaced (10') filbert trees, 10 years old were root grafted and experienced flashback (translocation from treated to untreated trees. Sevenyear-old trees had no flashback.
649. Lagerstedt, H. B. 1979. Filbert Tree Culture and Propagation. Proc. Nut Growers Soc. Ore., Wash., & B.C. 64:40.--Filbert trees spaced 15', 20' and 25' apart yielded an average of 12.2, 20.7 and 23.8 lbs of nuts each in 1978. On a per acre basis, these yields calculate out to 1,802, 2,032 and 1,759 lbs. respectively. This is only the third of 13 harvests in which the per acre yield from the 15' spacing has been surpassed. One inch long softwood leaf-stem cuttings of 'Butler' were induced to root within 30 days when treated with a 5 sec. dip of IBA 1,000 ppm and placed under mist with 80 F bottom heat. Even with such rapid rooting, a problem of bud abortion remains unsolved. About 70 rootstock selections have been made of which 44 have been propagated on their own roots and topworked with 'Ennis'. In 1978, 232 of these trees were placed in cooperating growers' orchards as part of an extensive rootstock evaluation program.
650. Lagerstedt, H. B. 1979. Filberts. Chapter in: Nut Tree Culture in North America. pp. 128-147. R. A. Jaynes, editor, Pub. No. Nut Growers Assoc., Hamden, CT.--This chapter covers filbert history, species, distribution,

economic importance and the commonly used cultivars. The methods of filbert propagation and its unusual floral biology is discussed. Orchard establishment, culture and management, pest control, harvesting and mechanization as practiced in the Pacific Northwest is covered.

651. Lagerstedt, H. B. 1979. Propagation-Seed, Grafting, Budding. Chapter in: Nut Tree Culture in North America. pp. 240-271. R. A. Jaynes, editor, Pub. No. Nut Growers Assoc., Hamden, CT.--The 3 primary nut tree propagation techniques - Seedage, graftage and budding - are emphasized. The principals involved, the practices used, some inovative ideas and methods for specific tree types are discussed.
652. Lagerstedt, H. B. 1979. A Review of Observations and Research on Eastern Filbert Blight in the Pacific Northwest. Ann. Rpt. No. Nut Growers Assoc. 70:22-30.--A quarantine against the importation of filbert plant parts into Oregon, Washington, and California was established in 1923. This quarantine was successful until the 1960's when the fungus Anisogramma anomala (Pk.) Muller which causes the disease eastern filbert blight (EFB), became established in a few orchards in the state of Washington. Its presence was discovered there in 1970, and recent surveys show it now to cover several hundred square miles including two orchards in Oregon. Its spread is slow There are no satisfactory cultural or chemical means of control. A single cultivar, 'Gassoway', of the European filbert, Corylus avellana L., has been found resistant to EFB.
653. Westigard, P. H. 1979. Codling Moth: Control on Pears with Diflubenzuron and Effects on Nontarget Pest and Beneficial Species. J. Econ Entomol. 72:552-554.--Diflubenzuron was evaluated in southern Oregon pear orchards for control of the codling moth, Laspeyresia pomonella (L.) and for effects on nontarget species. Diflubenzuron was most effective when the 1st summer treatment was timed to coincide with 1st moth flight in the late spring. Increased rates of diflubenzuron improved codling moth control but were more disruptive than lower rates to natural enemies of the pear psylla, Psylla pyricola Foerster. Diflubenzuron used at 0.14 kg AI/ha caused no reduction in psylla natural enemies compared to densities in untreated checks. Pear psylla levels were 3- to 4-fold higher in standard treatments with azinphosmethyl or phosmet compared to those in diflubenzuron plots. This was attributed to the reduction in natural enemies found in the organophosphate control program. No increase in two spotted spider mite, Tetranychus urticae Koch, densities was noted following diflubenzuron treatments compared to the untreated check plot.