1991-92 Comprehensive Project Report
to the Almond Board of California

Project Number: 91-M4

Project Title: Almond Variety Development

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Location: University of California at Davis

Objectives for 1991-92:

Long Range:

I. Develop pollinizers for current varieties, particularly Nonpareil.

II. Develop replacement varieties for Nonpareil and other market types that are self-fertile and with a wide range of bloom times and maturities.

Current:

A. Identify effective parental combinations resulting in high quality and yield, late flowering period and self-fertility. Begin studies to elucidate the underlying physiology and genetic control and inheritance of these traits.

B. Test genetic strategies for developing protection from Bud-failure, <u>Aspergillus</u> <u>flavus</u>, NOW, and other disease and insect problems, and for improving tree yield.

C. Improve the evaluation and testing of breeding lines and selections. Characterize nut quality and yield potential of present selections, breeding lines and variety standards.

D. Improve efficiency for the genetic transformation of established almond varieties. Develop efficient shoot regeneration methods. Develop protocols for testing the genetic stability of resultant chimeric shoots.

Progress Report: January, 1991 - January, 1992

The basic parts of a crop breeding program are the generation of new genetic combinations, the selection of promising individuals from these recombinant populations, and the thorough testing of these selections over the range of environments likely to be met in the course of production. The critical components of such a genetic improvement program are shown in Figure 1. This report emphasizes the first 4 of these sequential components: the determination of appropriate and focused goals for the breeding program, the appraisal and collection of genetic material with potential for achieving the defined goals, the recombination of genetic material in order to concentrate the most desirable genes from quality and production standpoints into superior individuals, and the screening of progeny populations resulting from this recombination in order to eliminate all but the most promising or elite selections.

Goal.

The primary goal of the breeding program is to develop more effective pollinizers for current varieties (particularly Nonpareil) and to develop replacement varieties for Nonpareil and other market types exhibiting dependable and high yields even under conditions of reduced agro-chemical and cultural inputs. Desirable characteristics include self-fertility and decreased vulnerability to insect and disease pests, and Bud-failure.

Source of genes.

The California almond germplasm is fairly inbred. While a complex series of crosses (or reshuffling of genes) often occurs before an elite selection is recovered, the majority of parents utilized are closely related, being derived from a small number of initial parents. In fact, most almond varieties of present commercial importance are progenies of crosses between Nonpareil and Mission. The pedigree of all advanced UC breeding lines and advanced selections has been determined and is provided in Table 1. Greater genetic diversity is available in this collection, particularly with the incorporation of germplasm from the related *Prunus* species *P. webbii*, *P. fenzliana*, *P. persica*, and *P.argentea*. The material within this collection represents the accumulated genetic improvements of the breeding program since its origin. Thus, an understanding of the goals, materials and strategies of earlier programs is essential for adequate assessment of the collection's present and future potential.

The almond breeding program has been in effect as a project of the California Agricultural Experiment Station since the early 1920's. This project was carried out jointly with the U.S. Department of Agriculture under the direction of A.E. Davey (UC) and Milo Wood (USDA) until 1946, at which time the programs were separated. Dr. Robert Jones directed the USDA program until its termination in 1972. E.F. Serr and Harold Forde continued UC almond breeding work evaluating seed from previous crosses by Davey and Wood as well as their own crosses made in 1950 and 1951. The goal of this early program was new kernel types, improved production and better pollinizers for Nonpareil.

Seedlings were grown in close-planted blocks located on UC land south of I-80 and were identified as (in chronology of planting): Walnut variety block, Walnut spacing block, Seedling block 1, Seedling block 2, Seedling block 3, and Close planting block.
Dr. Dale E. Kester began to make crosses in 1952 in attempts to develop a higher quality small kernel almond for the confectionery industry. Additional goals were: to incorporate late bloom and self-fertility, to understand the genetics of Noninfectious bud-failure, to develop peach x almond rootstocks, and to evaluate the potential of wild almond species for breeding. Progeny from crosses made by Kester were planted in consecutively identified seedling blocks (Seedling Block (SB) 1 through SB13). These were located in the central campus area (near present site of greenhouses and field house and later on the Stralach Farms area.)

Progeny populations resulting from the more recent crosses were identified by a unique numbering system. It consisted of the year that the cross was made coupled with a number identifying the individual cross. A dash separated this Cross No. with the seedling number given in the sequence of planting. Thus, 6018-01 would be the 18th cross made in 1960 with a seedling number of 01. (A compilation of the progeny produced in this program is continuing.)

In addition, three selection blocks were established to provide replicated tests of new selections arising from these progeny and to maintain germplasm.

1. Kearney field Station. Trees were propagated by the Dave Wilson nursery with two trees per each item. This block was very successful because of the favorability of the soil, irrigation system, climate and management. Jim Doyle managed the block and assisted by obtaining much of the data from these trees.
2. UC Davis. This block was established in the Straloch Farms west of the present orchard house area. It turned out to a less desirable site with relatively heavy soil that was poorly drained on the north end. Trees were slow to come into production as compared to those of Kearney.
3. Wolfskill Experimental Orchards, Winters. The original almond variety collection was located in the north corner of Field 7 close to the main buildings. The block was expanded to the south in 19 and included all the accumulated germplasm and selections at the time of its planting.

Varieties released from these programs

Davey (Serr, et.al., 1953) was released to provide a pollinizing variety that bloomed with Nonpareil and provide cross-pollination. Although planted in considerable number initially it quickly lost favor because of its excessive vigor and uprightness, slowness to come into bearing, and difficulty to manage including knocking and pruning problems.

Kapareil (Kester, et al., 1961) was released to provide a variety that closely resembled Nonpareil except for significantly smaller kernel size, which bloomed, harvested and cross-pollinated with Nonpareil.

Milow (distributed for test plantings in 1965). It was thought to provide an improved substitute for Kapareil with the same characteristics. The great difficulty in nut removal from the tree has pretty much ruled out its use as a commercial variety.

Sonora (Kester, et al., 1983) was released as an early blooming pollinator of Nonpareil with favorable nut and tree characteristics. It has become an important variety in recent plantings.

Padre (Kester, et al., 1983) was released as a companion with Mission (Texas) with similar characteristics of yield, nut and tree behavior. It has been found highly compatible with Marianna 2624 rootstock. Plantings have become significant in recent new orchards.

Solano (Kester, et al., 1983) was released because of its close resemblance in nut, tree, and blooming time with Nonpareil but with better shell characteristics. It is cross-compatible with Nonpareil. It is not being planted presumably because of difficulty in nut removal.

The last three varieties were selected from progeny of seed obtained by Serr and Ford from the UC-USDA program and planted in the UC orchards. Selection and evaluation was carried by USDA and then UC personnel.

Recent evaluations. In 1987, comprehensive surveys and evaluations were begun of all varieties, germplasm, and potential new introductions in the UC collections. Potentially valuable germplasm was propagated by a commercial nursery onto Nemaguard rootstocks and the various items were planted in spring 1988 into three basic collections.

A. Basic germplasm of the crop, including species and unique genotypes. these were transferred to the National Clonal Germplasm Repository,Davis (NCGP, Davis), a USDA facility located at UC Davis and WEO, Winters.

B. Dept. of Pomology Variety Collection, including old and current varieties supplement by some unnamed selections and genotypes. This collection is located at Wolfskill Experimental Orchard (Field 5). Financial assistance has been provided by the California Germplasm Resources Group for maintenance of this block (see Table 2).

C. Department of Pomology Breeding Collection including:

(1) Advanced selections of recent breeding efforts, primarily those originating from populations 1978 through 1980, (2) Breeding materials and advanced selections from previous efforts, and, (3) Miscellaneous germplasm materials with unique characteristics, including a number of genotypes from the USDA breeding program.

Breeding collection items have been planted on 2 blocks at the Wolfskill Research Station; Field 7 (Table 3) and Field 10D (Table 4). The reason for inclusion of each item into these advanced selection blocks is provided in the remarks (and/or the utility code columns of Table 10).

Limits in the genetic variability utilized by the earlier breeding programs restricted the amount of variation expressed in progeny populations. The Californian almond genepool is based upon 2 'founder' varieties -Nonpareil and Mission, with some contribution from the other 4 original varieties (IXL, Ne Plus Ultra, Peerles and Drake). In many ways this is an advantage as the original varieties were selected for their high adaptation to Californian environmental, management, and marketing conditions. Their progeny provides a wide range of recombination within this selected germplasm which can result in a high proportion of progeny populations retaining that high adaptation. This accounts for the large numbers of varieties that have originated as "chance seedlings" from commercial plantings.

However, this pattern produces potential for serious breeding problems. First of all, the gene pool includes undesirable traits that can adversely effect performance of specific varieties, (for example, susceptibility to noninfectious bud-failure, susceptibility to brown rot and shothole, late harvest, difficulty in knocking, NOW susceptibility from unsealed shells, etc.). Specific traits can be introduced when specific parents are introduced into the gene pool. For instance, the minor Harriot introduced excellent tree and nut characteristics but is a very early bloomer. When combining with Nonpareil a breeding line was produced which was very susceptible to noninfectious bud-failure. Eureka, another minor variety, introduces excellent kernel qualities and good production but also seems to introduce nuts that are hard to remove from the tree. Mission provides good tree characteristics but the nuts are often very late maturing. Many of the varieties introduced over the past 50 years, although desirable in various traits, have undesirable features which lead to their eventual rejection by orchardists. As a result, a changing pattern of variety introductions in nursery plantings has characterized its almond industry in California.

The inbred nature of the breeding populations can be a further major impediment to progress when the traits being selected for are not to be found with the population.

The lack of genetic solutions within earlier breeding populations has necessitated the incorporation of new germplasm for several important production problems, including self-fertility, improved yield potentials, and resistance to important disease and insect pests.

The incorporation of breeding material from other areas and species, while potentially introducing genetic solution to targeted problems, inevitably introduces a large amount of unadapted and undesirable genes which have to be painstakingly selected out. If the trait is controlled by a large number of genes, each of which contributes a relatively small positive contribution (quantitative traits) then selection for that trait is very difficult since each gene is probably linked to several undesirable genes and a very long and tedious crossing and recrossing program is needed to break those linkages as well as to concentrate the desirable genes into individual plants. Easier to deal with are traits where one or a few genes have a large positive effect (qualitative trait) as it facilitates incorporation into elite breeding lines. The ease of manipulation of a given genetic trait is referred to as its heritability, (the larger the heritability value the more easy to manipulate in a controlled crossing program). Estimates of the heritability of some important almond traits obtained from an analysis of progeny segregation patterns over the last 20 years are given in Table 5.

Recombination.

Genetic recombination is possible through controlled crosses between selected parents (sexual recombination) or through the insertion of genetically engineered genes into cells of the target plant followed by the regeneration of a whole plantlet from those cells (biotechnology).

Recombination by controlled crosses remains the fundamental approach to variety improvement employed by our program as well as virtually every other applied crop breeding program now in operation. In 1991, over 15,000 controlled crosses were made to parents selected for their potential horticultural contribution and estimated combining ability or complimentarity based on accumulated data. Almost 4,000 seedlings were grown last winter/spring from crosses made in 1990. Roughly 30% of these seedlings were killed by the frost and subsequent dry conditions with approximately 2,900 seedlings surviving (Table 6). Due to the unusually large size of 1990 and 1991 populations, combined with University budget cuts and reassignments of personnel responsibilities, this season's plantings have been reduced from the targeted 3,000 to 2,000. This lower planting will result in the continued infusion of new recombinant progeny into the program while allowing for some buffering of the work load in 1994-95 when the larger previously planted populations will come into bearing. Progress in direct data collection onto field computers, integrated database analysis, as well as improved cultural management efficiency should also offset field work loads. Further efficiency is anticipated through progress towards improved efficiencies with controlled crosses. One approach we are testing is the use of enclosed trees pollinated by mini honey bee hives. Tests in the past 2 seasons have confirmed the very high self-incompatibility of the California almond cultivars. Selfed seed sets less than 0.01%. By providing bouquets of fresh flowers from selected parents to completely enclosed, mini-hive containing trees in 1991, we have effected several hundred crosses with minimal labor. (The test occurred in Davis blocks and most fruit were subsequently damaged by the endemic crow population there). Our next step is to test similar honey bee mediated crosses to small containerized trees within a specialized screen house modified in 1990-1991 for this purpose. A second approach which we will test in 1992 is the collection of mature nuts from field plots of the selected seed parent where the desired pollen parent is the adjacent 'pollinizer' row. (Regional variety plots are well suited for such crosses due to the alternating row of Nonpareil or Mission). Based on honey bee pollinator behavior studies from California and Australia, we can be confident that a very high proportion of such selected seed results from the anticipated pollen parent. Paternity can later be verified using genetic fingerprinting techniques being developed in the Biochemical markers project with Dr. Arulsekar.

Biotechnology. While the regeneration of almond has been reported in other labs we have not moved aggressively in this area, primarily because the regeneration of plantlets has usually occurred when the original cells are from seedling rather than mature tissue. The most significant benefit biotechnology offers to almond breeding at this time is the correction of a specific deficiency of an already established variety, for example, self-fertility in Nonpareil. Successfully adding an engineered gene to a seedling (and so very probably horticulturally inferior) plant still leaves the daunting job of breeding through traditional crossing, the engineered gene into a suitable genetic background. (The reason plant tissue from established varieties will not regenerate into whole plants is poorly understood but probably relates to the loss of juvenility of that tissue -cuttings of established 'own rooted' varieties root poorly because of the same cause).

Research in this area accounts for only about 5% of the total project time. The goal is the regeneration of plantlets from transformed cells from established varieties (initially Nonpareil). Our approach is to employ cells that have never lost their ability to regenerate -i.e. cells from the plant meristem. The ability to isolate and regenerate this tissue would allow ready transformation/regeneration of any of the presently established varieties. The manipulation and regeneration from meristematic tissue would further allow the engineering of plant chimeras in which the Histogen 1 (H1) or epidermal layer including both fruit skin and the seed coat could be selected for disease and/or insect resistance leaving the inner varietal tissue unadulterated. Such H1 resistance could be recovered from either genetic engineering or traditional techniques.

Progeny screening.

Approximately 3,000 progeny trees are now being screened. These evaluations have the dual purpose of eliminating inferior material and collecting information on value of different crossing combinations (including susceptibility to Bud Failure). Accurate assessment of crossing combination value would allow a more efficient breeding program decisions in the future but would entail collecting extensive data on each individual. Descriptors and recognized standards for basic almond characteristics are summarized in Table 7, while specific evaluation criteria used in the UC breeding program for important field and marketing characteristics are provided in Table 8 (along with data from 11 varieties for comparisons) and in greater detail in Table 9. The 1991 performance of individual lines in the main UC breeding block (F10D) is summarized in Table 10. Most of this data pertains to nut quality though components of yield potential (Bearing units & Crop set) are also included. Yield, while being one of the most important aspects of a new variety, has been one of the most difficult to select for. Analyzing yield potential is complex not only because yield is the end product of a long chain of developmental events, each with separate genetic, environmental, and management components but often the events in one cycle may interfere with proper development and the succeeding cycle. Unless properly controlled this may lead to overall reduction in yield as well as to the expression of alternate bearing. To deal with this complexity, an Almond production model developed by D.E. Kester, is being used to assist screening and selections. A synopsis of this model is provided in Appendix A, with the main components summarized as follows.

Final yield in almond trees is a function of two parameters: Number of nuts per tree (Crop set) and the average weight of individual nuts. These two parameters translate into yield per tree or per acre as expressed in TOTAL POUNDS per tree (or per acre). Number of nuts per tree is a function of three basic factors: (a) blossom density, (b) proportion of flowers pollinated, and (c) number of nuts retained until harvest.

Figure 2 divides the yield parameters into three basic areas.

a) bearing density potential, b) reproduction potential and c) weight potential. Eight basic stages are shown which describe the continuous progress through the developmental cycles. Bearing potential is the blossom density created by the (1) growth processes and pattern of growth habit that developed during the early the part of the growing season, (2) the proportion of the buds in this pattern that were differentiated to become flower buds, and (c) the development of these buds during the fall and winter to produce viable flower buds the following spring.

The proportional of lateral buds on spurs and/or shoots that differentiate flowers can also be a limiting factor in yield. If the plants are overly vigorous and the variety does not bear on long shoots, the blossom density may be low. Vigor may be genetic (as in Davey) and/or stimulated because of heavy pruning, high fertilization, light crop due to frost or poor pollination, or highly fertile soil.

Poor bud development may be a factor in the ability of the flowers to set the next spring. In some years there is a heavy bud drop during winter, particularly if there is a warm dry period in fall and winter.

Reproductive potential refers to conditions during bloom and in the subsequent nut development period. The most important factor occurs at bloom and involves the ability of the flowers to be cross-pollinated. Pollen must be transferred from the anther to the flower by bees and this process must take place between two separate varieties whose pollen is compatible with each other.

Thus the crop potential in any one year depends upon the (a) amount of cross-pollination that occurred, (b) the ability of the pollen to fertilize the egg of that flower and (c) the relative probability of the flower to set fruit as evidently established by the previous development history of that flower. Experiments have shown that these factors are already established at the time of flowering, are independent of each other and is not influenced by the lack of pollination or set on any adjoining flower. The significance is that the amount of pollination needs to be maximized to produce maximum crop even though only a portion will actually continue to maturity. Percentages of 25 to 50 per cent set have been reported under good production conditions.

Other factors that may decrease crop include various defects in the kernel that must be eliminated at processing. These may include worm damage, shriveling, abortion, gumming and other conditions that affect quality. Each of these also have different parameters that affect their occurrence.

Weight potential is the third major category of factors that affect yield. Nut and kernel size, for instance, is established during the early part of the nut development period. Smaller nuts are produced with certain varieties, when very heavy set is produced, or sometimes when stresses occur during the growth period. On the other hand, weight of the kernel is established late in the nut development period and depends upon the translocation of storage materials into the kernel, notably leaf carbohydrates converted to fats and oil or protein. Moisture stress, poor foliage development, mites, etc. can affect these processes to reduce weight.

Growth habit refers to the relative arrangement of vegetative growth and flowers and nuts in relation to tree structure and growth and development patterns. The growth habit of a new selection, in many ways defines the yield potential of that selection. Different growth habits are characteristic of specific varieties which can be controlled through breeding and selection. Environmental conditions and particularly management in controlling vigor are extremely important in establishing optimum bearing potential so that breeding needs to be targeted to specific to specific cultural strategies.

Growth habit is defined as composed of different kinds of BEARING UNITS. A bearing unit is the structure that grows from a single bud within a single season with its associated flower buds. Growth may proceed from either terminal or lateral buds. An outline of the basic types of bearing units and associated growth habits are as follows (see also Appendix B and included drawings):

1. Flower buds are produced on long terminal shoots during the first year of growth to flower the second year of the cycle.

   a. Flowers are produced at single nodes of the shoot either separately or in combination with vegetative buds. Varieties with this habit include are Sonora, Ne Plus Ultra, Solano and Vesta. Varieties that have this kind of growth habit tend to come into bearing early.

   b. Flowers are produced on lateral shoots which develop the same year as the main shoot often in relation to flushes of growth (current season laterals). Occurs in Nonpareil, Ne Plus Ultra, many other varieties.

   c. Flowers are produced on short spur-like growth in place of or associated with current season's laterals. Referred to as annual spurs and can be associated with early, heavy yields. Occurs in such varieties as Butte, Carrion, Fritz, Carmel, Merced. To reach full potential of this type, young trees of these varieties respond to high vigor conditions when the trees are young.

2. Flowers are produced on lateral growth which emerge from lateral buds on long shoots. This type of growth habit requires two years to initiate flower buds and a third year to produce flowers and fruits.

   a. Spurs. The almond growth habit involves typical spurs. This structure grows from lateral buds on a shoot during one year, initiates single flower buds at each node and a second year to flower and Spurs are usually less than 5 inches along, may have 1 to 10 lateral flower buds, and only a single vegetative bud at the apex. If the spur is weak or if there is excessive fruit set on the spur, the apical bud may not survive and the spur lives only one year. On the other hand, if the apical bud survives, it may continue to elongate to produce more flower buds next year. This spur is considered perennial and may continue bearing for a number of years.

   b. Lateral shoots. Some varieties and species produce long lateral flower bearing shoots instead of spurs. These types of growth may also occur following certain development conditions in which the amount of growth is unusually long shoot (as compared to a spurs). These may also be referred to as " hangers" . This habit is common with various almond species, as Prunus fenzliana, P. argentea, etc. It is typically found in peach.

3. Mixed habits. Many varieties have combinations of both long shoots and spur development. In general this type tends to be associated with earlier and higher yields. This advantage

comes because the terminal shoot bearing habit results in rapid flower initiation in a young tree (early yield) which then reverts to the spur habit as the trees become older.

Multiplication -Field Testing - Release

Six selections have advanced through the breeding trials to the point where they are now being considered for inclusion in the next Regional Variety Plots. Final decision on these items will be made shortly, in order to arrange for virus testing and propagation. Descriptions of individual items follow are provided below:

13-1 5001-31 Sel. 3-1 x Sel 6-27

This selection has been one of the most productive selections as well as producing a very large tree which has a dense canopy of very green leaves. It was tested at Kearney Field Station and at the UCD Selection block. 1979 data from Kearney shows to have the highest yield of its group. Kernel size was 31/oz. with 56% to be virus positive and subsequently heat treated.

25-75 (Arbuckle x Alm. sel. 24-6)45-96 x [(<u>Prunus</u> <u>mira</u> x unknown almond) 1-31 x Alm Sel. 3C-29]4-24E

Self-fertile and believed to have a high level of self-pollinating ability. Late Bloom. Trees are being propagated at Burchell Nursery and Dave Wilson nursery for establishing test orchards in Fresno and Kern Cos. under test agreement.

2-19E Tardy Nonpareil x Arbuckle. Late blooming variety with good performance and reasonably good nut. Matures medium just after Nonpareil. Not difficult to knock. Compatible with Nonpareil, Mission, Arbuckle and Padre and 2-19.

2-43/W Tardy Nonpareil x Arbuckle. Similar to and intercompatible with 2-19E. Potential for planting together.

Figure 1

Genetic Improvement Program

Goal

|

Source of genes

|

Combine new genes with
genes for other desireable crop traits

|

Screen

|

Select

|

Multiply

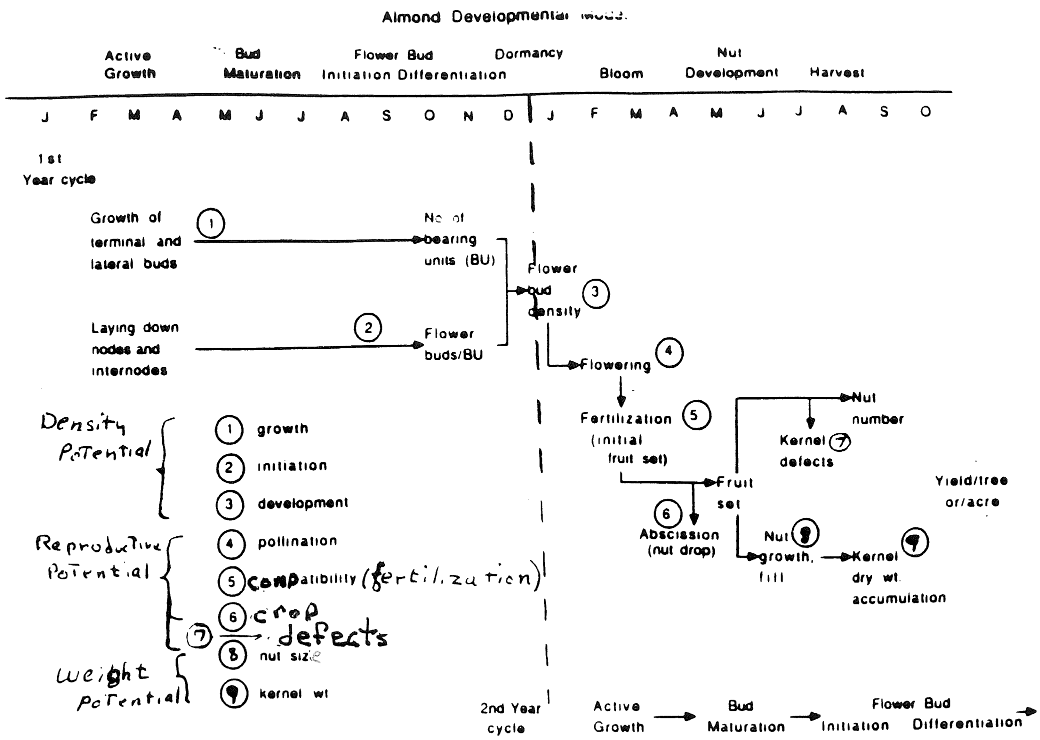
|

Field Test

|

Release

Figure 2


Almond Developmental Mode.
Active Growth
Bud Maturation
Flower Bud Initiation Differentiation
Dormancy
Bloom
Nut Development
Harvest
J F M A M J J A S O N D J F M A M J J A S O
1st Year cycle
Growth of terminal and lateral buds
No of bearing units (BU)
Laying down nodes and internodes
Flower buds/BU
Flower bud density
Flowering
Fertilization (initial fruit set)
Fruit set
Abscission (nut drop)
Nut number
Kernel defects
Nut growth, fill
Kernel dry wt. accumulation
Yield/tree or/acre
Density Potential
1 growth
2 initiation
3 development
Reproductive Potential
4 pollination
5 compatibility (fertilization)
6 crop
7 defects
8 nut size
Weight Potential
9 kernel wt
2nd Year cycle
Active Growth
Bud Maturation
Flower Bud Initiation Differentiation

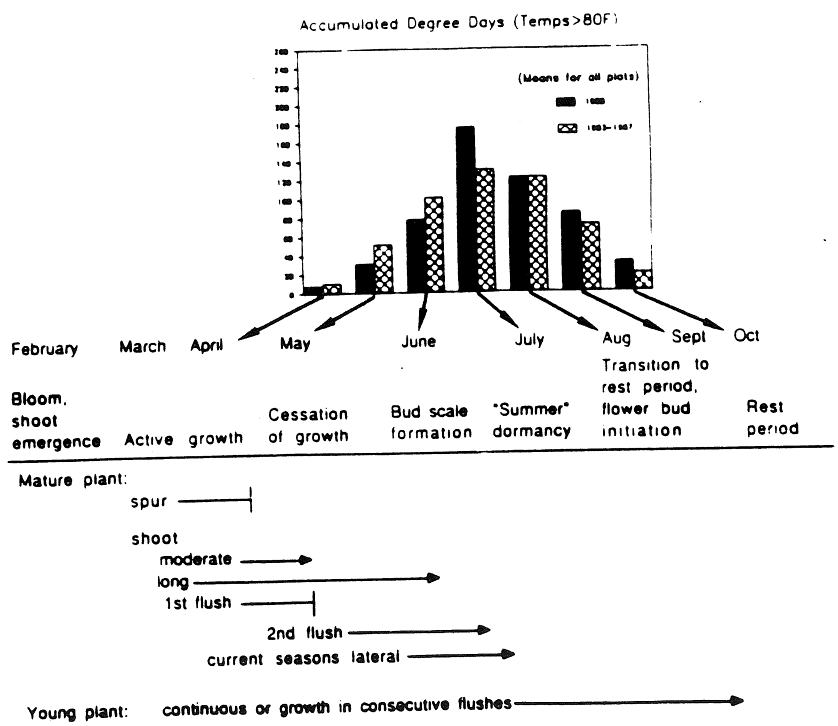

Accumulated Degree Days (Temps>80F)
(Means for all plots)
February
March
April
May
June
July
Aug
Sept
Oct
Bloom, shoot emergence
Active growth
Cessation of growth
Bud scale formation
"Summer" dormancy
Transition to rest period, flower bud initiation
Rest period
Mature plant:
spur
shoot
moderate
long
1st flush
2nd flush
current seasons lateral
Young plant:
continuous or growth in consecutive flushes

Table 1
Pedigree of some Almond Selections and Cultivars   PAGE 1   31-May-90

File= AlmParent   Parentage of items collected for Selection and Breeding
Blocks: F5. F7 and F10D at WEO

Cultivar or Synonym	Cultivar or Selection	PARENTS Seed	Pollen	Parents of SEED parent Seed	Pollen	Parents of POLLEN parent Seed	Pollen	REMARKS
7926-1	1	Padre	54P455	Texas		Swanson		F8S.EastRow
7926-2	2	Padre	54P455					F8S.EastRow
	20-20	Sultana	Mission					
	21-19A	Nonpareil	A.1-30			Nonpareil	Eureka	
	24A-11A	A.18-1	A.2-32	Nonpareil	Bidwell	Nonpareil	Eureka	
	24-6	Eureka	A.5-25			Nonpareil	Eureka	
	25-26	A.1-37	A.9-18	Nonpareil	Eureka	Nonpareil	Harriott	
	25-7	Nonpareil	Levelling					
7926-3	3	Padre	54P455	Texas	Swanson			F8S.EastRow
7926-4	4	Padre	54P455					F8S.EastRow
	40A-17							Peach.Nematode immune
7926-5	5	Padre	54P455					F8S.EastRow
7926-6	6	Padre	54P455					F8S.EastRow
F7.6A-11	6A-11	Jordanolo	25-7	Nonpareil	Harriott	Nonpareil	Levelling	
	A.18-1	Nonpareil	Bidwell					
	A.1-30	Nonpareil	Eureka					
	A.1-37	Nonpareil	Eureka					
	A.2-32	Nonpareil	Eureka					
	A.5-25	Nonpareil	Eureka					
	A.9-18	Nonpareil	Harriott					
	Almendro de la pie							
	Almond#1							
	Almond#2							
	Almond#4							
	Almond#5							
	Almond#6							
	Arbuckle							Late bloom
	SB16.9-64	Mission	Pruebbii					
	Bigelow -							
	Butte -							
	Carmel -							
	CP.5-33	Reams	McLish					
	CP.5-46	Reams	McLish					
Padre	CP.5-58	Reams	McLish					
3-3	Davey	Nonpareil	SansFaute					1953
	Eureka							Old cultivar
	F10C.12-28	F8.72-33	OP	SB11.2-2	54P455			Med.tree.upright.short shoots+spurs.bitt
	F10C.15-1	F8.72-36	OP	SB11.2-2	54P455			Upright.bitter kernel.self-fruitful
	F10C.15-2	F8.72-36	OP	SB11.2-2	54P455			Very small tree.bitter kernel
	F10C.20-51	F8.76-45	OP	NonpareilBF	54P455			Compact.self-fruitful.bitter kernel
	F10C.25-10	F8.71-31	OP	Well'sNonpareil	54P455			Dwarf,self-fruitful
	F10C.29-41	F8.72-35	OP	SB11.2-2	54P455			Dwarf,shade tolerant.dble flower,rough b
	F10C.29-45	F8.72-35	OP	SB11.2-2	54P455			Dwarf.shade tolerant.rough bark
	F10C.30-79	F8.73-41	OP	Titan	54P455			Dwarf,small pit
	F10C.32-22	F8.71-65	OP	NonpareilBF	54P455			Medium tree.v.long pit
	F10C.9-22	F8.72-6	OP	F7.6A-11	54P455			Short shoots and spurs:sweet kernel.self
	F5.10-2	SB20.1-5	Sonora	Mission	HybridA			
	F5.10-52	SB20.1-19	Sonora	Mission	Pruebbii			
	F5.10-7	SB20.1-5	Sonora	Mission	HybridA			
	F5.10-9	SB20.1-5	Sonora	Mission	HybridA			
	F5.11-77	SB20.1-28	Sonora	Mission	Prargentea			

File= AlmParent Parentage of items collected for Selection and Breeding

Blocks: F5, F7 and F100 at WEO

Cultivar or	Cultivar or	PARENTS		Parents of SEED parent		Parents of POLLEN parent		
Synonym	Selection	Seed	Pollen	Seed	Pollen	Seed	Pollen	REMARKS
	F5,13-54	SB20.1-5	Sonora	Mission	HybridA			
	F5,14-75	SB20,1-28	Sonora	Mission	Prargentea			
	F5,14-81	Milow	F5,3-60			SB.16.2-37	SB6.56-98	
	F5,15-26	Padre	SB20,1-29	Texas	Swanso	Mission	Prwebbii	
	F5,15-27	Padre	SB20,1-29			Mission	Prwebbii	
	F5,15-29	Padre	SB20.1-29			Mission	Prwebbii	
	F5,16-1	SB7.2-1E	F5.3-52	Mission	Kapareil	SB.16.2-37	SB6.56-98	
	F5,16-2	SB7,2-1E	F5,3-52	Mission	Kapareil	SB.16.2-37	SB6,56-98	
	F5,16-60	SB20.1-21	SB20.1-29	Mission	Prwebbii	Mission	Prwebbii	
	F5,17-78	SB7,2-1E	SB20.1-29	Mission	Kapareil	Mission	Prwebbii	
	F5,18-61	Nonpareil	F5.3-2			Titan	SB16,12-66	
	F5,18-64	Nonpareil	F5,4-4			SB16.2-44	SB6,56-88	
	F5,18-73	Nonpareil	F5.4-4			SB16,2-44	SB6,56-88	
	F5,18-75	Nonpareil	F5,4-4			SB16.2-44	SB6,56-88	
	F5,19-13	Nonpareil	F5.4-11			SB16.2-44	SB6.56-88	
	F5,19-49	Nonpareil	F5.4-43					
	F5,19-53	Nonpareil	F5,4-43					
	F5,19-8	Nonpareil	F5,4-6			SB16.2-44	SB6.56-88	
	F5.19-82	Padre	F5.3-2	Texas	Swanso	Titan	SB16.12-66	
	F5,19-90	Padre	F5,4-4			SB16,2-44	SB6.56-88	
	F5,20-38	Padre	F5.4-10			SB16,2-44	SB6.56-88	
	F5,20-42	Padre	F5.4-10			SB16,2-44	SB6.56-88	
	F5,20-44	Padre	F5.4-10			SB16.2-44	SB6,56-88	
	F5,20-52	Padre	F5,4-10			SB16.2-44	SB6.56-88	
	F5,2-22	Titan	SB16.8-60					
	F5,3-2	Titan	SB16.12-66			TardyNonpareil	Prwebbii	
	F5,3-20	Titan	SB16,12-64			TardyNonpareil	Prwebbii	
	F5,3-39							
	F5,3-52	SB.16,2-37	SB6,56-98	Prwebbii	Self	SolSel,5-15	Self	
	F5.3-60	SB.16.2-37	SB6.56-98	Prwebbii	Self	SolSel.5-15	Self	
	F5,4-10	SB16,2-44	SB6.56-88	Prwebbii	Prwebbii	SolSel.5-15	24-6	
	F5,4-11	SB16.2-44	SB6.56-88	Prwebbii	Prwebbii	SolSel.5-15	24-6	
	F5,4-3	SB16.2-44	SB6,56-88	Prwebbii	Prwebbii	SolSel.5-15	24-6	
	F5,4-4	SB16,2-44	SB6.56-88	Prwebbii	Prwebbii	SolSel,5-15	24-6	
	F5,4-42	SB16.9-59	SB16,9-60	Mission	Prwebbii	Mission	Prwebbii	
	F5,4-43							
	F5,4-5	SB16,2-44	SB6.56-88	Prwebbii	Prwebbii	SolSel.5-15	24-6	
	F5.4-6	SB16,2-44	SB6.56-88	Prwebbii	Prwebbii	SolSel.5-15	24-6	
	F5,4-62	SB16.9-62	OP	Mission	Prwebbii			
	F5,5-47	SB16,12-64	OP	TardyNonpareil	Prwebbii			
	F5,5-58	SB16,12-64	OP	TardyNonpareil	Prwebbii			
	F5.6-1	SB20,1-5	Sonora	Mission	HybridA			
	F5,6-13	SB20,1-5	Sonora	Mission	HybridA			
	F5,6-22	SB20,1-5	Sonora	Mission	HybridA			
	F5,7-103	SB20,1-23	Sonora	Mission	Prwebbii			
	F5.7-46	SB20.1-21	Sonora	Mission	Prwebbii			
	F5.8-29	SB20,1-28	Sonora	Mission	Prargentea			
	F5,8-31	SB20.1-28	Sonora	Mission	Prargentea			
	F5,8-33	SB20,1-28	Sonora	Mission	Prargentea			
	F5,8-64	Milow	F5,3-39					
	F5,8-78	Milow	F5.3-39					

File= AlmParent Parentage of items collected for Selection and Breeding
Blocks: F5, F7 and F10D at WEO

Cultivar or	Cultivar or	PARENTS		Parents of SEED parent		Parents of POLLEN parent		
Synonym	Selection	Seed	Pollen	Seed	Pollen	Seed	Pollen	REMARKS
SB2,6A-11	F7,6A-11	Jordanolo	25-7	Nonpareil	Harriott	Nonpareil	Levelling	
	F8,22-15	Mission	MissionXLukensHoney			Mission	Lukens Honey peach	
	F8,71-31	Well'sNonpareil	54P455					
	F8,71-65	NonpareilBF	54P455					
	F8,72-33	SB11,2-2	54P455	TardyNonpareil	Jordanolo			
	F8,72-35	SB11,2-2	54P455	TardyNonpareil	Jordanolo			
	F8,72-36	SB11,2-2	54P455	TardyNonpareil	Jordanolo			
	F8,72-6	F7,6A-11	54P455	Jordanolo	25-7			
	F8,73-41	Titan	54P455					
	F8,76-45	NonpareilBF	54P455					
	F8N,6-27	F5,4-6	Solano	SB16,2-44	SB6,56-88			
	F8N,6-68	F5,4-10	Milow or Solano	SB16,2-44	SB6,56-88			
	F8N,7-11	F5,4-10	Solano	SB16,2-44	SB6,56-88			
	F8N,7-13	F5,4-10	Solano	SB16,2-44	SB6,56-88			
	F8N,7-16	F5,4-10	Solano	SB16,2-44	SB6,56-88			
	F8N,7-4	F5,4-10	Solano	SB16,2-44	SB6,56-88			
	F8N,7-56	Nonpareil	F5,4-42			SB16,9-59	SB16,9-60	
	F8N,8-20	F5,4-6	Solano	SB16,2-44	SB6,56-88			
	F8N,8-25	F5,4-6	Solano	SB16,2-44	SB6,56-88			
	F8N,8-3	Padre	F5,4-4	Reams	McLish	SB16,2-44	SB6,56-88	
	F8N,8-53	F5,4-6	Solano	SB16,2-44	SB6,56-88			
	F8N,8-9	F5,4-6	Solano	SB16,2-44	SB6,56-88			
	F8S,51-12	J.H.Hale	Carmel					
	F8S,51-14	J.H.Hale	Carmel					
	F8S,51-20	J.H.Hale	Carmel					
	F8S,51-27	J.H.Hale	Butte					
	F8S,51-32	FayElberta	Butte					Spur type
	F8S,51-36	FayElberta	Butte					Spur type
	F8S,53-60							
	F8S,59-1	SB13,28-21	F5,3-43	SB2,45-96	SB4,5-58E			Self-fertile?
	Ferradeul							
	Ferragnes							
	GoldenState							
	H62(peach)							
	Harpareil							
	Harriott							
PI228327	HybridA	Prfenzliana	Almond?					
	IXL							
	Jordanolo	Nonpareil	Harriott					
	Kapareil	Nonpareil	24-6			Eureka	A,5-25	
	Kutsch							Chance Sdlg
	LaMarie							
	Langeudoc							Historical item
	LaPrima							Hatch variety
	LeGrandSdlg	LeGrand	OP					Medium tree,spurs
	Levelling							
	LongIXL							
	Marcona							
	McLish							
	Milow	(same as Kapareil						
	Mission							

File= AlmParent Parentage of items collected for Selection and Breeding
Blocks: F5. F7 and F10D at WEO

Cultivar or Synonym	Cultivar or Selection	PARENTS Seed	Pollen	Parents of SEED parent Seed	Pollen	Parents of POLLEN parent Seed	Pollen	REMARKS
	Monterey							
	NePlusUltra							
	Nonpareil							
CP,5-58	Padre							
	Peerless	Swanson	Sport					
	Pioneer	Prpersica	Pramygdalus					PA,Self-fert.:peach-like
	PlPath.1-15							From irrad-ted bitter almond:Crown gall
	PlPath.1-5							From irrad-ted bitter almond;Crown gall
	PlPath.2-15							From irrad-ted bitter almond:Crown gall
	PlPath.2-28							From irrad-ted bitter almond
	Prhortulana							
	Price							
	Reams							
	SansFaute							
	SB,16.2-37	Prwebbii	Self					
	SB1,16-44	Prfenzliana	Nonpareil					
	SB1,16-46	Prfenzliana	Nonpareil					
	SB1.16-62	Prfenzliana	Nonpareil					
	SB1.4A-12	20-20	24A-11	Sultana	Mission			USDA-UC Selection
	SB11.2-2	TardyNonpareil	Jordanolo(?)			Nonpareil	Harriott	Irrad.10,000 Rads
	SB12.2-24	Prwebbii	Prwebbii					
	SB13.25-75	SB2.45-96	SB4.4-24E	Arbuckle	24-6			Self-fertile
	SB13.28-21	SB2.45-96	SB4.5-58E	Arbuckle	24-6			Self-fertile
	SB13.36-51	SB3.54-39E	25-26	SolSel.5-15	WSB.3B-25	A.1-37	A.9-18	Self-fertile
	SB13.36-52	SB3.54-39E	25-26	SolSel.5-15	WSB.3B-25	A.1-37	A.9-18	Self-fertile
	SB13.37-9	SB3.54-39E	25-26	SolSel.5-15	WSB.3B-25	A.1-37	A.9-18	Self-fertile
	SB13.45-7	SB3.54-42E	OP	SolSel.5-15	WSB.3B-25			Self-fertile
	SB13.45-8	SB3.54-42E	OP	SolSel,5-15	WSB.3B-25			Self-fertile
	SB16,12-64	TardyNonpareil	Prwebbii					
	SB16.12-66	TardyNonpareil	Prwebbii					
[redacted]6827-2A	SB16.14-13	PlPath.1-5	H62(peach)					PA hybrid
[redacted]6828-1C	SB16.14-16	PlPath.1-5	40A-17(peach)					~~Vegetatively prop-ed Rs clone selection~~ PA hybrid
	SB16.2-44	Prwebbii	Prwebbii					
	SB16.4-12	CP,5-33	TardyNonpareil	Reams	McLeash	—	—	
	SB16.4-55	TardyNonpareil	25-26			A.1-37	A.9-18	
	SB16.8-60	Nonpareil	Davey			Nonpareil	SansFaute	
	SB16.9-59	Mission	Prwebbii					
	SB16.9-60	Mission	Prwebbii					
	SB16.9-60	Mission	Prwebbii					
	SB16.9-62	Mission	Prwebbii					
	SB16.9-9	Mission	HybridA			Prfenzliana	Almond	
	SB2.45-96	Arbuckle	24-6			Eureka	A.5-25	
	SB2,6A-11	Jordanolo	25-7	Nonpareil	Harriott	Nonpareil	Levelling	
	SB20.1-19	Mission	Prwebbii					
	SB20.1-21	Mission	Prwebbii					
	SB20,1-23	Mission	Prwebbii					
	SB20.1-28	Mission	Prargentea					
	SB20.1-29	Mission	Prwebbii					
	SB20,1-5	Mission	HybridA			Prfenzliana	Almond	
	SB3.53-25W	Prfenzliana	Almond					
	SB3,54-15W	SolSel.5-15	TardyNonpareil	Nonpareil	LukensHoneyXMission			Self-fertile

File= AlmParent Parentage of items collected for Selection and Breeding
Blocks: F5. F7 and F10D at WEO

Cultivar or Synonym	Cultivar or Selection	PARENTS Seed	Pollen	Parents of SEED parent Seed	Pollen	Parents of POLLEN parent Seed	Pollen	REMARKS
	SB3.54-39E	SolSel.5-15	WSB.3B-25	Nonpareil	LukensHoneyXMission			Self-fertile
	SB3,54-42E	SolSel,5-15	WSB.3B-25	Nonpareil	LukensHoneyXMission			Self-fertile
	SB3.55-13W	SolSel,5-15	TardyNonpareil	Nonpareil	LukensHoneyXMission			Self-fertile
	SB3.7A-17	21-19A	22-40	Nonpareil	A.1-30			
	SB4,1-100W	WSB,3C-29	CP.5-33			Reams	McLish	Late bloom,productive
	SB4,2-19E	TardyNonpareil	Arbuckle					
	SB4.2-43W	TardyNonpareil	Arbuckle					
	SB6.53-24-7	F8,22-15	Self	Mission	MissionXLukensHoney			Affected Br2
	SB6.56-88	SolSel,5-15	24-6	Nonpareil	LukensHoneyXEureka		A.5-25	
	SB6,56-88	SolSel.5-15	24-6	Nonpareil	LukensHoneyXEureka		A,5-25	Self-fertile
	SB6.56-89	SolSel,5-15	Self	Nonpareil	LukensHoneyXMission			Self-fertile
	SB6.56-98	SolSel.5-15	Self	Nonpareil	LukensHoneyXMission			Self-fertile
	SB7,1-87W	Mission	Paxman					
	SB7,2-1E	Mission	Kapareil			Nonpareil	24-6	
	SB7,2-82W	Nonpareil	Kaparel			Nonpareil	24-6	
	SB8,1-45W	SB1,16-44	OP	Prfenzliana	Nonpareil			
	SB8,1-50W	SB1,16-46	OP	Prfenzliana	Nonpareil			
	SB8,2-4W	SB1,16-62	OP	Prfenzliana	Nonpareil			
	SB8.3-100W	SB3.53-25W	OP	Prfenzliana	Almond			
	SB8,4-3E	SB3,53-25W	OP	Prfenzliana	Almond			
	SmithIXL							
	Solano							
	SolSel.5-15	Nonpareil	LukensHoneyXMission					
5A-20	Sonora							
	Standard							
	SydneySpecial							
	TardyNonpareil							
	Tarragona							
	Thompson							
	Titan							
PI223477.It	Trusito							Self-fert.
	Unknown							
	USDA,10A-14XSelf							
	USDA,14-87							
	USDA,18-130							
	USDA,18.5-8							
	USDA.19.5-12							
	USDA,19.5-8							
	USDA.19.5-9							
	USDA.20.5-13							
	USDA,20.5-18							
	USDA,25-26 X Self							
	USDA,75-3							
	USDA,92-59							
	USDA.CP.5-33 OP							
USDA,16.5-8	Vesta							
	Walton							
	WestSteyn	Nonpareil	Budmutation					

Table 2

File = F5_88Pr Almond Variety Collection WEO Field 5
Planted: Rows 1-5 Febr.8.1988
Row-tree 1-1 at the NW corner; Nemaguard rootstock for both almonds and peaches
Peaches : All virus-free items: Planted: 2/13/90

Source	Location BkRowTree	Item	Origin, remarks
	Almonds		
F7,12-9	F5.1-6	Almendro de la pie	
F7,12-9	F5,2-6	Almendro de la pie	
F7.2-18	F5.3-2	Arbuckle	Late bloom
F7,2-18	F5.4-2	Arbuckle	Late bloom
F7.13-18	F5.1-5	Bigelow	
F7,13-18	F5.2-5	Bigelow	
	F5,5-17	Butte	
	F5.5-18	Butte	
	F5,5-11	Carmel	
	F5.5-12	Carmel	Dead'90
F7.1-13	F5.3-3	CP.5-46	
F7.1-13	F5.4-3	CP.5-46	
NFO.A12-16	F5.3-9	Davey	
NFO,A12-16	F5.4-9	Davey	
F7,2-12	F5.3-11	Eureka	Old cultivar.much used in breeding
F7,2-12	F5.4-11	Eureka	Dead'90
F7,6-4	F5.1-10	GoldenState	
F7,6-4	F5.2-10	GoldenState	Dead'90
F7,12-17	F5.1-8	Harriott	
F7.12-17	F5.2-8	Harriott	
F7.9-15	F5.1-9	IXL	
F7.9-15	F5.2-9	IXL	
NFO.C3-18	F5.1-1	Jordanolo	
NFO.C3-18	F5.2-1	Jordanolo	
NFO.T12	F5.1-16	Kapareil	
NFO,T12	F5.2-16	Kapareil	
F7,15-5	F5.3-18	Kutsch	Chance Sdlg
F7.15-5	F5,4-18	Kutsch	
F7,14-15	F5.1-17	LaMarie	
F7.14-15	F5.2-17	LaMarie	

File = F5_88Pr Almond Variety Collection WEO Field 5
Planted: Rows 1-5 Febr.8,1988
Row-tree 1-1 at the NW corner: Nemaguard rootstock for both almonds and peaches
Peaches : All virus-free items: Planted: 2/13/90

Source	Location BkRowTree	Item	Origin, remarks
F7,14-2	F5,3-4	Langeudoc	Historical item
F7,14-2	F5,4-4	Langeudoc	Historical item
F7,10-15	F5,1-15	LaPrima	Hatch variety
F7,10-15	F5,2-15	LaPrima	Hatch variety
F7,12-15	F5,3-16	Lewelling	
F7,12-15	F5,4-16	Lewelling	
F7,11-14	F5,3-15	LongIXL	
F7,11-14	F5,4-15	LongIXL	
F7,11-17	F5,1-3	Marcona	Dead'90
F7,11-17	F5,2-3	Marcona	
NF0,C7-23	F5,3-10	Milow	
NF0,C7-23	F5,4-10	Milow	
NF0,A12-19	F5,3-1	Mission	
NF0,A12-19	F5,4-1	Mission	
	F5,5-13	Monterey	Dead'90
	F5,5-14	Monterey	Dead'90
NF0,A12-8	F5,1-4	NePlusUltra	Dead'90
NF0,A12-8	F5,2-4	NePlusUltra	
NF0,C15-15	F5,3-12	Nonpareil	
NF0,C15-15	F5,4-12	Nonpareil	Same as 3-12 ?, diff.growth
NF0,A13-4	F5,3-7	Padre	
NF0,A13-4	F5,4-7	Padre	
NF0,C4-8	F5,1-7	Peerless	
NF0,C4-8	F5,2-7	Peerless	
F7,3-17	F5,5-1	Pioneer	PA.Self-fert.:peach-like
F7,3-17	F5,5-2	Pioneer	
	F5,5-15	Price	
	F5,5-16	Price	Dead'90
F7,3-13	F5,3-8	SansFaute	
F7,3-13	F5,4-8	SansFaute	
F7,1-11	F5,3-17	SB1,4A-12	(SultanaxMission)20-20x((Nonp.xBidwell)a18-1x(nonp.xEureka)a2-32)24A-11
F7,1-11	F5,4-17	SB1,4A-12	USDA-UC Selection
F7,3-15	F5,1-12	SB2,6A-11	Jordanolo x (Nonpareil x Lewelling)25-7
F7,3-15	F5,2-12	SB2,6A-11	Jordanolo x (Nonpareil x Lewelling)25-7

File = F5_88Pr Almond Variety Collection WEO Field 5
Planted: Rows 1-5 Febr.8.1988
Row-tree 1-1 at the NW corner: Nemaguard rootstock for both almonds and peaches
Peaches : All virus-free items: Planted: 2/13/90

Source	Location BkRowTree	Item	Origin, remarks
F7.1-12	F5.3-14	SB3.7A-17	21-19A x 22-40
F7.1-12	F5.4-14	SB3.7A-17	21-19A x 22-40
F7.4-5	F5.5-10	SB7.1-87W	Mission x Fayman
F7.4-5	F5.5-9	SB7.1-87W	Sick'90
F7.15-7	F5.1-18	SmithIXL	
F7.15-7	F5.2-18	SmithIXL	
NFO.C4-16	F5.1-11	Sonora	
NFO.C4-16	F5.2-11	Sonora	Dead'90
F7.12-5	F5.5-7	Standard	Dead'90
F7.12-5	F5.5-8	Standard	Dead'90
F7.3-14E	F5.1-14	SydneySpecial	
F7.3-14E	F5.2-14	SydneySpecial	
F7.13-3	F5.3-5	TardyNonpareil	Dead'90
F7.13-3	F5.4-5	TardyNonpareil	
F7.11-5	F5.1-2	Tarragona	
F7.11-5	F5.2-2	Tarragona	Dead'90
NFO.C15-17	F5.5-3	Thompson	
NFO.C15-17	F5.5-4	Thompson	
SBD.12-4	F5.1-13	Trusito	PI223477.Ital:Self-fert..strong tree.good habit.hard-shelled.22%kernel)
SBD.12-4	F5.2-13	Trusito	PI223477.Ital:Self-fert..strong tree.good habit.hard-shelled.22%kernel)
NFO.A12-15	F5.3-13	Vesta	
NFO.A12-15	F5.4-13	Vesta	
F7.14-7	F5.3-6	Walton	
F7.14-7	F5.4-6	Walton	
F7.11-5	F5.5-5	WestSteyn	Dead'90
F7.11-5	F5.5-6	WestSteyn	Bud mutation of Nonpareil

File = F5_88Pr Almond Variety Collection WEO Field 5
Planted: Rows 1-5 Febr.8.1988
Row-tree 1-1 at the NW corner; Nemaguard rootstock for both almonds and peaches
Peaches : All virus-free items; Planted: 2/13/90

Source	Location BkRowTree	Item	Origin, remarks
	Peaches		
Smith Nurs.	F5,6-7	19.2-72	
Smith Nurs.	F5,6-8	19,2-72	
Smith Nurs.	F5.6-10	Andross	
Smith Nurs.	F5,6-9	Andross	
Smith Nurs.	F5,6-15	CarolynG	
Smith Nurs.	F5,6-16	CarolynG	
Smith Nurs.	F5,6-3	Carson	
Smith Nurs.	F5,6-4	Carson	
Smith Nurs.	F5,6-13	DrDavis	
Smith Nurs.	F5.6-14	DrDavis	
Smith Nurs.	F5,6-17	Halford	
Smith Nurs.	F5.6-18	Halford	
Smith Nurs.	F5.6-5	Klamt	
Smith Nurs.	F5,6-6	Klamt	
Smith Nurs.	F5,6-1	Loadel	
Smith Nurs.	F5.6-2	Loadel	
Smith Nurs.	F5,6-11	Ross	
Smith Nurs.	F5.6-12	Ross	
Smith Nurs.	F5.7-15	Starn	
Smith Nurs.	F5,7-16	Starn	
Smith Nurs.	F5.7-17	Wiser	
Smith Nurs.	F5,7-18	Wiser	

Table 3

Almond Selection and Breeding Block # 1 WEO Field 7 Planted: Febr.1988
File = F7_88Pr Rows East to West. Trees North to South

RS	SOURCE	Location BkRowTree	I T E M	PARENTS Seed	Pollen	Remarks
	F7Old	F7.8-3	40A-17			Peach.nematode immune
	F7Old	F7.9-3	40A-17			Peach.nematode immune
NEMA	F8S.59-1	F7.11-3	F8S.59-1	SB13.28-21	F5.3-43	Sel'87 for self-fertility
NEMA	F8S.59-1	F7.12-3	F8S.59-1	SB13.28-21	F5.3-43	Sel'87 for self-fertility
	F7Old	F7.3-4	Ferradeul			
	F7Old	F7.4-4	Ferradeul			
	F7Old	F7.6-4	Ferradeul			
	F7Old	F7.5-4	Ferragnes			
	F7Old	F7.7-4	Ferragnes			
	F7Old	F7.6-6	Harpareil			
	F7Old	F7.3-6	Jordanolo.BF	out		
	F7Old	F7.2-2	MissionShawBFG			
	F7Old	F7.3-2	MissionShawBFG			
	F7Old	F7.1-3	Mission-3-6-1			
	F7Old	F7.6-3	Mission-3-6-1			
	F7Old	F7.7-6	Nonpareil.BF			
	F7Old	F7.8-6	Nonpareil.IR-2			
	F7Old	F7.7-1	Nonpareil-125			
	F7Old	F7.6-2	Nonpareil-3-8-2 unique number			
NEMA	SBD.19-15	F7.7-5	SB13.25-75	SB2.45-96	SB4.4-24E	Self-fertile
NEMA	SBD.19-15	F7.8-5	SB13.25-75	SB2.45-96	SB4.4-24E	Self-fertile
NEMA	SBD.19-17	F7.1-2	SB13.28-21	SB2.45-96	SB4.5-58E	Self-fertile
NEMA	SBD.19-17	F7.1-4	SB13.28-21	SB2.45-96	SB4.5-58E	Self-fertile
NEMA	SBD.19-2	F7.11-6	SB13.36-51	SB3.54-39E	25-26	Self-fertile
NEMA	SBD.19-2	F7.12-6	SB13.36-51	SB3.54-39E	25-26	Self-fertile
NEMA	SBD.18-3	F7.10-5	SB13.36-52	SB3.54-39E	25-26	Self-fertile
NEMA	SBD.18-3	F7.9-5	SB13.36-52	SB3.54-39E	25-26	Self-fertile
NEMA	SBD.19-11	F7.10-7	SB13.37-9	SB3.54-39E	25-26	Self-fertile
NEMA	SBD.19-11	F7.12-7	SB13.37-9	SB3.54-39E	25-26	Self-fertile
NEMA	SBD.19-5	F7.10-6	SB13.45-7	SB3.54-42E	OP	Self-fertile
NEMA	SBD.19-5	F7.9-6	SB13.45-7	SB3.54-42E	OP	Self-fertile
NEMA	SBD.19-10	F7.11-5	SB13.45-8	SB3.54-42E	OP	Self-fertile
NEMA	SBD.19-10	F7.12-5	SB13.45-8	SB3.54-42E	OP	Self-fertile

Almond Selection and Breeding Block # 1 WEO Field 7 Planted: Febr.1988
File = F7_88Pr Rows East to West. Trees North to South

RS	SOURCE	Location BkRowTree	I T E M	PARENTS Seed	Pollen	Remarks
	F7old	F7.5-1	SB16.4-12	CP.5-33	TardyNonpareil	
	F7old	F7.6-1	SB16.4-12	CP.5-33	TardyNonpareil	
	F7old	F7.8-1	SB16.4-55	TardyNonpareil 25-6		
NEMA	F7,4-15E	F7,7-2	SB3.54-15W	SOL.SEL.5-15	TardyNonpareil	Self-fertile
NEMA	F7,4-15E	F7,7-3	SB3.54-15W	SOL.SEL.5-15	TardyNonpareil	Self-fertile
NEMA	F7,3-6E	F7,1-1	SB3.54-39E	SOL.SEL.5-15	WSB,3B-25	Self-fertile
NEMA	F7,3-6E	F7,2-1	SB3.54-39E	SOL.SEL.5-15	WSB.3B-25	Self-fertile
NEMA	F7,3-6NW	F7,1-5	SB3,54-42E	SOL.SEL.5-15	WSB,3B-25	Self-fertile
NEMA	F7.3-6NW	F7,2-5	SB3,54-42E	SOL.SEL.5-15	WSB.3B-25	Self-fertile
NEMA	F7.3-6S	F7,3-1	SB3.55-13W	SOL.SEL.5-15	TardyNonpareil	Self-fertile
NEMA	F7,3-6S	F7,4-1	SB3,55-13W	SOL.SEL.5-15	TardyNonpareil	Self-fertile
NEMA	F7.6-17	F7,2-3	SB4.1-100W	WSB.3C-29	CP.5-33	Late bloom,productive
NEMA	F7.6-17	F7,3-3	SB4,1-100W	WSB.3C-29	CP.5-33	Late bloom,productive
NEMA	F7.6-15	F7,6-5	SB4,1-102W	WSB.3C-29	CP.5-33	Late bloom,productive
NEMA	SBD.17-13	F7.10-3	SB4.2-19E	TardyNonpareil	Arbuckle	
NEMA	SBD,17-13	F7,8-4	SB4.2-19E	TardyNonpareil	Arbuckle	
NEMA	SBD.18-10	F7,4-3	SB4.2-43W	TardyNonpareil	Arbuckle	
NEMA	SBD,18-10	F7,5-3	SB4,2-43W	TardyNonpareil	Arbuckle	
NEMA	SB18,1-59	F7,1-6	SB6.53-24-7	F8.22-15	Self	Normal Br1
NEMA	SB18.1-71	F7,5-5	SB6.53-24-7	F8,22-15	Self	Affected Br2
NEMA	SBD,12-3	F7,10-1	SB6,56-88	SOL.SEL,5-15	24-6	Self-fertile
NEMA	SBD.12-3	F7,9-1	SB6.56-88	SOL.SEL.5-15	24-6	Self-fertile
NEMA	F7,8-3	F7.11-1	SB6,56-89	SOL.SEL.5-15	Self	Self-fertile
NEMA	SBD.10-13	F7,11-2	SB6,56-89	SOL.SEL,5-15	Self	Self-fertile
NEMA	F7,8-3	F7,12-1	SB6,56-89	SOL.SEL.5-15	Self	Self-fertile
NEMA	SBD.10-13	F7,12-2	SB6,56-89	SOL.SEL.5-15	Self	Self-fertile
NEMA	SBD,10-9	F7,10-2	SB6.56-98	SOL.SEL,5-15	Self	Self-fertile
NEMA	SBD.10-9	F7,9-2	SB6.56-98	SOL.SEL.5-15	Self	Self-fertile
NEMA	F7,4-5	F7,4-2	SB7,1-87W	Mission	Paxman	
NEMA	F7,4-5	F7,5-2	SB7,1-87W	Mission	Paxman	
NEMA	SBD,10-11	F7,11-4	SB7.2-82W	Nonpareil	Kaparel	
NEMA	SBD,10-11	F7,12-4	SB7,2-82W	Nonpareil	Kaparel	
	F7old	F7.8-2	Unknown			

Almond Selection and Breeding Block 1 23-May-90

File = F7_88MAP Planted: 2/88
Location: WEO, Field 7 NE corner. East of South Citrus Block.
Row 1-Tr 1 on the NE corner. Row 12 next to Citrus Block.

--------)) North

Row	7	6	5	4	3	2	1 (-Tree	Row
12	SB13,37-9	SB13,36-51	SB13,45-8	SB7,2-82W	F8S,59-1	SB6,56-89	SB6,56-89	12
11		SB13,36-51	SB13,45-8	SB7,2-82W	F8S,59-1	SB6,56-89	SB6,56-89	11
10	SB13,37-9	SB13,45-7	SB13,36-52		SB4,2-19E	SB6,56-98	SB6,56-88	10
9		SB13,45-7	SB13,36-52		40A-17	SB6,56-98	SB6,56-88	9
8		Nonpareil,IR-2	SB13,25-75	SB4,2-19E	40A-17		SB16,4-55	8
7		Nonpareil,BF	SB13,25-75	Ferragnes	SB3,54-15W	SB3,54-15W	Nonpareil-125	7
6		Harpareil	SB4.1-102W	Ferradeul	Mission-3-6-1	Nonpareil-3-8-2	SB16,4-12	6
5		Harpareil	SB6,53-24-7 Affected Br2	Ferragnes	SB4,2-43W	SB7,1-87W	SB16,4-12	5
4				Ferradeul	SB4,2-43W	SB7,1-87W	SB3,55-13W	4
3		Jordanolo,BF		Ferradeul	SB4,1-100W	MissionShawBFG	SB3,55-13W	3
2			SB3,54-42E		SB4,1-100W	MissionShawBFG	SB3,54-39	2
1		SB6,53-24-7 Normal Br1	SB3,54-42E	SB13,28-21	Mission-3-6-1	SB13,28-21	SB3,54-39	1
Row	7	6	5	4	3	2	1 (-Tree	Row

Table 4

Almonds, F10D Block Sorted on LOCATION DrKester's copy PAGE 2 28-May-90

File = F10D_88Pr Almond SELECTION AND BREEDING BLOCK#2 WEO Field 10D
Planted: Rows 1-9 2/8/88; Rows 9-17 to 10-26 Fbr.'90 Rootstock = Nemaguard
Row-tree 1-1 at the SW corner, Rows increase toward North.

Source	Cultivar or Selection	Location BkRowTree	Parental Pedigree	REMARKS
F5,8-78	7924-19 7923-24?	F10D,2-1	Milow X F5,3-39	
F8N,6-27	8021-89	F10D,2-2	F5,4-6 X Solano	
F5,10-7	7906-31	F10D,2-3	(Mission x HybridA)SB20,1-5 X Sonora	
F5,10-52	7914-26	F10D,2-4	(Mission X PrWebbii)SB20,1-19 X Sonora	
F8N,8-53	8021-77	F10D,2-5	F5,4-6 X Solano	
F5,10-2	7906-26 27?	F10D,2-6	(Mission x HybridA)SB20,1-5 X Sonora	
F5,6-1	7906-1	F10D,2-7	(Mission x HybridA)SB20,1-5 X Sonora	
F5,16-1	7934-54	F10D,2-8	SB7,2-1E X F5,3-52	
F7,3-15	6A-11	F10D,2-9	(Jordanolo X(Nonpareil X Lewelling)25-7	
NFO,C4-16	Sonora	F10D,2-10	F P M S	
F5,8-64	7924-5	F10D,2-11	Milow X F5,3-39	
SBD,10-5	6003-2	F10D,2-12	(PrFenzliana X Nonpareil)SB1,16-46	
F8N,6-68	8023-18	F10D,2-13	F5,4-10 X Milow or Solano	
SBD,11-4	6003-13	F10D,2-14	(PrFenzliana X Nonpareil)SB1,16-62	
SBD,11-3	6002-38	F10D,2-15	(PrFenzliana X Nonpareil)SB1,16-44	
F8N,7-16	8024-24	F10D,2-16	F5,4-10 X Solano	
F8N,7-13	8024-21	F10D,2-17	F5,4-10 X Solano	
F5,18-73	8007-24 18?	F10D,2-18	Nonpareil X F5,4-4	
F5,2-22	7309-7	F10D,2-19	Titan X (Nonpareil x Davey)SB16,8-60	
NFO,C15-15	Nonpareil	F10D,2-20	F P M S	
F5,8-31	7920-22	F10D,2-21	(Mission x Prargentea)SB20,1-28 X Sonora	
F5,19-53	8011-24 11?	F10D,2-22	Nonpareil X F5,4-43	
F5,19-8	8009-2	F10D,2-23	Nonpareil X F5,4-4	
F5,20-44	8016-26 9?	F10D,2-24	Padre X F5,4-10	
F5,7-103	7918-16	F10D,2-25	(Mission x PrWebbii)SWB20,1-21 X Sonora	
F5,18-64	8007-15 24?	F10D,2-26	Nonpareil X F5,4-4	

File = F10D_88Pr Almond SELECTION AND BREEDING BLOCK#2 WEO Field 10D
Planted: Rows 1-9 2/8/88; Rows 9-17 to 10-26 Fbr.'90 Rootstock = Nemaguard
Row-tree 1-1 at the SW corner, Rows increase toward North.

Source	Cultivar or Selection	Location BkRowTree	Parental Pedigree	REMARKS
F5,10-9	7906-33	F10D,3-1	(Mission x HybridA)SB20,1-5 X Sonora	
F8N,8-20	8011-24	F10D,3-2	F5,4-6 X Solano	
F5,11-77	7920-45	F10D,3-3	(Mission x Prargentea)SB20,1-28 X Sonora	
F5,16-60	7915-88	F10D,3-4	(Mission x PrWebbii)SWB20,1-21 X (Mission X PrWebbii)SB20,1-29	
F5,8-33	7920-24 11?	F10D,3-5	(Mission x Prargentea)SB20,1-28 X Sonora	
F8N,7-4	8024-12	F10D,3-6	F5,4-10 X Solano	
F5,14-81	7923-55	F10D,3-7	Milow X F5,3-60	
F5,8-29	7920-20	F10D,3-8	(Mission x Prargentea)SB20,1-28 X Sonora	
F5,16-2	7934-55	F10D,3-9	SB7,2-1E X F5,3-52	
F5,15-29	7927-56	F10D,3-10	Padre X SB20,1-29	
F8S,53-60	F8S,53-60	F10D,3-11		
F5,17-78	7932-87	F10D,3-12	SB7,2-1E X SB20,1-29	
F5,15-27	7927-54	F10D,3-13	Padre X SB20,1-29	
F5,20-42	8016-24 5?	F10D,3-14	Padre X F5,4-10	
F5,19-49	8011-20 7933-97?	F10D,3-15	Nonpareil X F5,4-43	
F5,18-61	8006-10	F10D,3-16	Nonpareil X F5,3-2	
F5,20-52	8016-34 6?	F10D,3-17	Padre X F5,4-10	
F5,6-13	7906-13	F10D,3-18	(Mission x HybridA)SB20,1-5 X Sonora	
F5,13-54	7906-53	F10D,3-19	(Mission x HybridA)SB20,1-5 X Sonora	
F5,15-26	7927-53	F10D,3-20	Padre X SB20,1-29	
F5,20-38	8016-20 17?	F10D,3-21	Padre X F5,4-10	
F8N,7-11	8024-19	F10D,3-22	F5,4-10 X Solano	
F8N,8-3	8013-6	F10D,3-23	Padre X F5,4-4	
F5,3-20	7310-26 46?	F10D,3-24	Titan X (Tardy Nonpareil x PrWebii)SB16,12-64	
F5,19-13	8010-22	F10D,3-25	Nonpareil X F5,4-11	
F8N,8-25	8021-19	F10D,3-26	F5,4-6 X Solano	

File = F10D_88Pr Almond SELECTION AND BREEDING BLOCK#2 WEO Field 10D
Planted: Rows 1-9 2/8/88; Rows 9-17 to 10-26 Fbr.'90 Rootstock = Nemaguard
Row-tree 1-1 at the SW corner, Rows increase toward North.

Source	Cultivar or Selection	Location BkRowTree	Parental Pedigree	REMARKS
F5,10-9	7906-33	F10D,4-1	(Mission x HybridA)SB20,1-5 X Sonora	
F8N,8-20	8011-24	F10D,4-2	F5,4-6 X Solano	
F5,11-77	7920-45	F10D,4-3	(Mission x Prargentea)SB20,1-28 X Sonora	
F5,16-60	7915-88	F10D,4-4	(Mission x PrWebbii)SWB20,1-21 X Sonora	
F5,8-33	7920-24 11?	F10D,4-5	(Mission x Prargentea)SB20,1-28 X Sonora	
F8N,7-4	8024-12	F10D,4-6	F5,4-10 X Solano	
F5,14-81	7923-55	F10D,4-7	Milow X F5,3-60	
F5,8-29	7920-20	F10D,4-8	(Mission x Prargentea)SB20,1-28 X Sonora	
F5,16-2	7934-55	F10D,4-9	SB7,2-1E X F5,3-52	
F5,15-29	7927-56	F10D,4-10	Padre X SB20,1-29	
F8S,53-60	F8S,53-60	F10D,4-11		
F5,17-78	7932-87	F10D,4-12	SB7,2-1E X SB20,1-29	
F5,15-27	7927-54	F10D,4-13	Padre X SB20,1-29	
F5,20-42	8016-24 5?	F10D,4-14	Padre X F5,4-10	
F5,19-49	8011-20 7933-97?	F10D,4-15	Nonpareil X F5,4-43	
F5,18-61	8006-10	F10D,4-16	Nonpareil X F5,3-2	
F5,20-52	8016-34 6?	F10D,4-17	Padre X F5,4-10	
F5,6-13	7906-13	F10D,4-18	(Mission x HybridA)SB20,1-5 X Sonora	
F5,13-54	7906-53	F10D,4-19	(Mission x HybridA)SB20,1-5 X Sonora	
F5,15-26	7927-53	F10D,4-20	Padre X SB20,1-29	
F5,20-38	8016-20 17?	F10D,4-21	Padre X F5,4-10	
F8N,7-11	8024-19	F10D,4-22	F5,4-10 X Solano	
F8N,8-3	8013-6	F10D,4-23	Padre X F5,4-4	
F5,3-20	7310-26 46?	F10D,4-24	Titan X (Tardy Nonpareil x PrWebii)SB16,12-64	
F5,19-13	8010-22	F10D,4-25	Nonpareil X F5,4-11	
F8N,8-25	8021-19	F10D,4-26	F5,4-6 X Solano	

File = F10D_88Pr Almond SELECTION AND BREEDING BLOCK#2 WEO Field 10D
Planted: Rows 1-9 2/8/88; Rows 9-17 to 10-26 Fbr.'90 Rootstock = Nemaguard
Row-tree 1-1 at the SW corner, Rows increase toward North.

Source	Cultivar or Selection	Location BkRowTree	Parental Pedigree	REMARKS
SB22,2-76	USDA,75-3	F10D,5-1		
F8S,51-32	7803-10	F10D,5-2	FayElberta X Butte	Spur type
NFO,A13-4	Padre	F10D,5-3	~~(Reams X Mclish)~~CP%-58 Mission X Swanson	FPMS 3-
SB22,2-68	USDA,CP,5-33 OP	F10D,5-4		
SB23,1-113	USDA,20.5-13	F10D,5-5		
F5,5-58	7347-16	F10D,5-6	(Mission x PrWebbi)SB16,9-64 X OP	
F5,5-47	7347-5	F10D,5-7	(Mission x PrWebbi)SB16,9-64 X OP	
NFO,A12-19	Mission	F10D,5-8	FPMS 3-B-5 65	
F5,5-57	7347-15	F10D,5-9	(Mission x PrWebbi)SB16,9-64 X OP	
F8S,51-36	7803-14	F10D,5-10	FayElberta X Butte	Spur type
SB22,2-78	USDA,19.5-12	F10D,5-11		
F5,4-62	7340-5	F10D,5-12	(Mission x PrWebbi)SB16,9-62 X OP	
F7,9-1NW	SB8,3-100W	F10D,5-13	(PrFenzliana X Almond)SB3,53-25W X OP	
SBD,16-18	USDA,92-59	F10D,5-14		
SB22,2-74	USDA,25-26xSelf	F10D,5-15		
F8S,51-20	7804-10	F10D,5-16	J.H.Hale X Carmel	
F8S,51-27	7805-5	F10D,5-17	J.H.Hale X Butte	
F5,4-3	7326-1	F10D,5-18	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
F5,4-10	7326-8	F10D,5-19	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
F8S,EastRow	7926-6	F10D,5-20	Padre x 54P-455 dwarf peach	
F8S,EastRow	7926-2	F10D,5-21	Padre x 54P-455 dwarf peach	
F8N,8-9	8021-	F10D,5-22	F5,4-6 X Solano	
F5,7-46	7916-9	F10D,5-23	(Mission x PrWebbii)SWB20,1-21 X Sonora	Budded in place ~~Not prop-ed at Burchell'87~~
F5,6-22	7906-22	F10D,5-24	(Mission x HybridA)SB20,1-5 X Sonora	~~Not prop-ed at Burchell'87~~ Budded in place
F5,19-90	8013-19 12?	F10D,5-25	Padre X F5,4-4	
F5,18-75	8007-16 15?	F10D,5-26	Nonpareil X F5,4-4	

File = F10D_88Pr Almond SELECTION AND BREEDING BLOCK#2 WEO Field 10D
Planted: Rows 1-9 2/8/88; Rows 9-17 to 10-26 Fbr.'90 Rootstock = Nemaguard
Row-tree 1-1 at the SW corner, Rows increase toward North.

Source	Cultivar or Selection	Location BkRowTree	Parental Pedigree	REMARKS
SB22,2-76	USDA,75-3	F10D,6-1		
F8S,51-32	7803-10	F10D,6-2	FayElberta X Butte	Spur type
NFO,A13-4	Padre	F10D,6-3	(Reams X McLish)CP%-58	
SB22,2-68	USDA,CP,5-33 OP	F10D,6-4		
SB23,1-113	USDA,20.5-13	F10D,6-5		
F5,5-58	7347-16	F10D,6-6	(Mission x PrWebbi)SB16,9-64 X OP	
F5,5-47	7347-5	F10D,6-7	(Mission x PrWebbi)SB16,9-64 X OP	
NFO,A12-19	Mission	F10D,6-8	TPMS 3-6-5-65	
F5,5-57	7347-15	F10D,6-9	(Mission x PrWebbi)SB16,9-64 X OP	
F8S,51-36	7803-14	F10D,6-10	FayElberta X Butte	Spur type
SB22,2-78	USDA,19.5-12	F10D,6-11		
F5,4-62	7340-5	F10D,6-12	(Mission x PrWebbi)SB16,9-62 X OP	
F7,9-1NW	SB8,3-100W	F10D,6-13	(PrFenzliana X Almond)SB3,53-25W X OP	
SBD,16-18	USDA,92-59	F10D,6-14		
SB22,2-74	USDA,25-26xSelf	F10D,6-15		
F8S,51-20	7804-10	F10D,6-16	J.H.Hale X Carmel	
F8S,51-27	7805-5	F10D,6-17	J.H.Hale X Butte	
F5,4-3	7326-1	F10D,6-18	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
F5,4-10	7326-8	F10D,6-19	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
F8S,EastRow	7926-6	F10D,6-20	Padre x 54P-455	
F8S,EastRow	7926-2	F10D,6-21	Padre x 54P-455	
F8N,8-9	8021-	F10D,6-22	F5,4-6 X Solano	
F5,7-46	7916-9	F10D,6-23	(Mission x PrWebbii)SWB20,1-21 X Sonora	Not prop-ed at Burchell'87
F5,6-22	7906-22	F10D,6-24	(Mission x HybridA)SB20,1-5 X Sonora	Not prop-ed at Burchell'87
F5,19-90	8013-19 12?	F10D,6-25	Padre X F5,4-4	
F5,18-75	8007-16 15?	F10D,6-26	Nonpareil X F5,4-4	

File = F10D_88Pr Almond SELECTION AND BREEDING BLOCK#2 WEO Field 10D
Planted: Rows 1-9 2/8/88; Rows 9-17 to 10-26 Fbr.'90 Rootstock = Nemaguard
Row-tree 1-1 at the SW corner, Rows increase toward North.

Source	Cultivar or Selection	Location BkRowTree	Parental Pedigree	REMARKS
F7,3-4E	PP,1-15	F10D,7-1		From irrad-ted bitter almond;Crown gall resistant
SB22,2-82	USDA,18-130	F10D,7-2		
SB22,2-71	USDA,10A-14xSelf	F10D,7-3		
F5,4-42	7339-2	F10D,7-4	(Mission x PrWebbi)SB16,9-59 X (Mission x PrWebbii))SB16,9-60	
NF0,C15-17	Thompson	F10D,7-5	FPMS	
F8S,51-12	7804-2	F10D,7-6	J.H.Hale X Carmel	
SB22,2-85	USDA,20.5-18	F10D,7-7		
F7,6-7S	SB8,4-3E	F10D,7-8	(PrFenzliana X Almond)SB3,53-25W X OP	
SB23,1-97	USDA,14-87	F10D,7-9		
F5,4-6	7326-4	F10D,7-10	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
SB22,2-66	USDA,18.5-8	F10D,7-11		
SB23,1-96	USDA,19.5-9	F10D,7-12		
F8S,51-14	7804-4	F10D,7-13	J.H.Hale X Carmel	
F7,22-15	40A-17	F10D,7-14		Peach,Nematode immune
SB22,2-72	USDA,19.5-8	F10D,7-15		
SB23,1-99	USDA,20.5-13	F10D,7-16		
F5,4-5	7326-3	F10D,7-17	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
SB20,1-5	6855-1	F10D,7-18	PrFenzliana Bckgrnd	
F8S,EastRow	7926-3	F10D,7-19	Padre X 54P-455	
F8S,EastRow	7926-5	F10D,7-20	Padre X 54P-455	
F5,4-4	7326-2	F10D,7-21	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
F8S,EastRow	7926-1	F10D,7-22	Padre X 54P-455	
F8S,EastRow	7926-4	F10D,7-23	Padre X 54P-455	
F5,14-75	7920-61	F10D,7-24	(Mission x Prargentea)SB20,1-28 X Sonora	Not prop-ed at Burchell'87
F8N,7-56	8011-29	F10D,7-25	Nonpareil X F5,4-42	
F5,19-82	8012-29 33?	F10D,7-26	Padre X F5,3-2	

File = F10D_88Pr Almond SELECTION AND BREEDING BLOCK#2 WEO Field 10D
Planted: Rows 1-9 2/8/88; Rows 9-17 to 10-26 Fbr.'90 Rootstock = Nemaguard
Row-tree 1-1 at the SW corner, Rows increase toward North.

Source	Cultivar or Selection	Location BkRowTree	Parental Pedigree	REMARKS
F7,3-4E	PP,1-15	F10D,8-1		From irrad-ted bitter almond;Crown gall resistant
SB22,2-82	USDA,18-130	F10D,8-2		
SB22,2-71	USDA,10A-14xSelf	F10D,8-3		
F5,4-42	7339-2	F10D,8-4	(Mission x PrWebbi)SB16,9-59 X (Mission x PrWebbii))SB16,9-60	
NF0,C15-17	Thompson	F10D,8-5	FPMS	
F8S,51-12	7804-2	F10D,8-6	J.H.Hale X Carmel	
SB22,2-85	USDA,20.5-18	F10D,8-7		
F7,6-7S	SB8,4-3E	F10D,8-8	(PrFenzliana X Almond)SB3,53-25W X OP	
SB23,1-97	USDA,14-87	F10D,8-9		
F5,4-6	7326-4	F10D,8-10	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
SB22,2-66	USDA,18.5-8	F10D,8-11		
SB23,1-96	USDA,19.5-9	F10D,8-12		
F8S,51-14	7804-4	F10D,8-13	J.H.Hale X Carmel	
F7,22-15	40A-17	F10D,8-14		Peach,Nematode immune
SB22,2-72	USDA,19.5-8	F10D,8-15		
SB23,1-99	USDA,20.5-13	F10D,8-16		
F5,4-5	7326-3	F10D,8-17	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
SB20,1-5	6855-1	F10D,8-18	PrFenzliana Bckgrnd	
F8S,EastRow	7926-3	F10D,8-19	Padre x 54P-455	
F8S,EastRow	7926-5	F10D,8-20	Padre x 54P-455	
F5,4-4	7326-2	F10D,8-21	(PrWebbi x PrWebbi)SB12,2-24 X (SolSel,5-15 x 24-6)SB6,56-88	
F8S,EastRow	7926-1	F10D,8-22	Padre x 54P-455	
F8S,EastRow	7926-4	F10D,8-23	Padre x 54P-455	
F5,14-75	7920-61	F10D,8-24	(Mission x Prargentea)SB20,1-28 X Sonora	Not prop-ed at Burchell'87
F8N,7-56	8011-29	F10D,8-25	Nonpareil X F5,4-42	
F5,19-82	8012-29 33?	F10D,8-26	Padre X F5,3-2	

File = F10D_88Pr Almond SELECTION AND BREEDING BLOCK#2 WEO Field 10D
Planted: Rows 1-9 2/8/88; Rows 9-17 to 10-26 Fbr.'90 Rootstock = Nemaguard
Row-tree 1-1 at the SW corner, Rows increase toward North.

Source	Cultivar or Selection	Location BkRowTree	Parental Pedigree	REMARKS
F7,3-4SE	PP,1-5	F10D,9-1		From irrad-ted bitter almond;Crown gall resistant
F7,3-4SE	PP,1-5	F10D,9-2		From irrad-ted bitter almond;Crown gall resistant
F7,3-4W	PP,1-15	F10D,9-3		From irrad-ted bitter almond;Crown gall resistant
F7,3-4W	PP,1-15	F10D,9-4		From irrad-ted bitter almond;Crown gall resistant
SBD,15-22	PP,2-28	F10D,9-5		From irrad-ted bitter almond
SBD,15-22	PP,2-28	F10D,9-6		From irrad-ted bitter almond
SB19,1-29	Wayland704op	F10D,9-7		
SB19,1-29	Wayland704op	F10D,9-8		
SB19,2-39	PA,6828-1C	F10D,9-9	PP,1-5 X 40A-17;4-9-17	Vegetatively prop-ed Rs clone selection
SB19,2-39	PA,6828-1C	F10D,9-10	PP,1-5 X 40A-17;4-9-17	Vegetatively prop-ed Rs clone selection
SB19,2-50	PP,1-15	F10D,9-11		From irrad-ted bitter almond;Crown gall resistant
SB19,2-50	PP,1-15	F10D,9-12		From irrad-ted bitter almond;Crown gall resistant
SB19,2-41	PA,6827-2A	F10D,9-13	PP,1-5 X H62;1-22-16	
SB19,2-41	PA,6827-2A	F10D,9-14	PP,1-5 X H62;1-22-16	
~~SB19,1-26~~	Wayland702op	F10D,9-15		
SB19,1-26	Wayland702op	F10D,9-16		
SBD,12-4	Trusito	F10D,9-17		
SBD,12-4	Trusito	F10D,9-18		
F7,5-4	Peerless	F10D,9-19	Swanson sport	Crinkle leaf sport?
F7,5-4	Peerless	F10D,9-20	Swanson sport	" " "
F10C,9-22	F10C,9-22	F10D,9-21	F8,72-6 X OP	Short shoots and spurs;sweet kernel,self-fruitful
F10C,9-22	F10C,9-22	F10D,9-22	F8,72-6 X OP	Short shoots and spurs;sweet kernel,self-fruitful
F10C,15-1	F10C,15-1	F10D,9-23	F8,72-36 X OP	Upright,bitter kernel,self-fruitful
F10C,15-1	F10C,15-1	F10D,9-24	F8,72-36 X OP	Upright,bitter kernel,self-fruitful
F10C,12-28	F10C,12-28	F10D,9-25	F8,72-22 X OP	Med.tree,upright,short shoots+spurs,bitter kernel
F10C,12-28	F10C,12-28	F10D,9-26	F8,72-22 X OP	Med.tree,upright,short shoots+spurs,bitter kernel

File = F10D_88Pr Almond SELECTION AND BREEDING BLOCK#2 WEO Field 10D
Planted: Rows 1-9 2/8/88; Rows 9-17 to 10-26 Fbr.'90 Rootstock = Nemaguard
Row-tree 1-1 at the SW corner, Rows increase toward North.

Source	Cultivar or Selection	Location BkRowTree	Parental Pedigree	REMARKS
~~F10C,25-10~~	F10C,25-10	F10D,10-1	F8,71-31 X OP	Dwarf,self-fruitful
~~F10C,25-10~~	F10C,25-10	F10D,10-2	F8,71-31 X OP	Dwarf,self-fruitful
	LeGrandSdlg	F10D,10-3	LeGrand X OP	Medium tree,spurs
	LeGrandSdlg	F10D,10-4	LeGrand X OP	Medium tree,spurs
DrKester	Almond#4	F10D,10-5		
DrKester	Almond#4	F10D,10-6		
DrKester	Almond#1	F10D,10-7		
DrKester	Almond#1	F10D,10-8		
SB6,53-25-2	Almond#2	F10D,10-9		
SB6,53-25-2	Almond#2	F10D,10-10		
~~DrKester~~	Almond#5	F10D,10-11		
DrKester	Almond#5	F10D,10-12		
DrKester	Almond#6	F10D,10-13		
DrKester	Almond#6	F10D,10-14		
~~F10C,20-51~~	F10C,20-51	F10D,10-15	F8,76-45 X OP	Compact,self-fruitful,bitter kernel
~~F10C,20-51~~	F10C,20-51	F10D,10-16	F8,76-45 X OP	Compact,self-fruitful,bitter kernel
~~F10C,32-22~~	F10C,32-22	F10D,10-17	F8,71-65 X OP	Medium tree,v.long pit
~~F10C,32-22~~	F10C,32-22	F10D,10-18	F8,71-65 X OP	Medium tree,v.long pit
~~F10C,15-2~~	F10C,15-2	F10D,10-19	F8,72-36 X OP	Very small tree,bitter kernel
~~F10C,15-2~~	F10C,15-2	F10D,10-20	F8,72-36 X OP	Very small tree,bitter kernel
~~F10C,29-45~~	F10C,29-45	F10D,10-21	F8,72-35 X OP	Dwarf,shade tolerant,rough bark
~~F10C,29-45~~	F10C,29-45	F10D,10-22	F8,72-35 X OP	Dwarf,shade tolerant,rough bark
~~F10C,30-79~~	F10C,30-79	F10D,10-23	F8,73-41 X OP	Dwarf,small pit
~~F10C,30-79~~	F10C,30-79	F10D,10-24	F8,73-41 X OP	Dwarf,small pit
~~F10C,29-41~~	F10C,29-41	F10D,10-25	F8,72-35 X OP	Dwarf,shade tolerant,dble flower,rough bark
~~F10C,29-41~~	F10C,29-41	F10D,10-26	F8,72-35 X OP	Dwarf,shade tolerant,dble flower,rough bark

Table 5 Estimates of Heritability of Some Nut Traits in Almond.

Trait	Heritability
Bitterness	99
Crease	79
Kernel length	77
Kernel thickness	71
Kernel weight	64
Kernel width	62
Shell type	55
Double kernels	51
Shell sealed	42
Kernel color	42
Retention of outer shell	34
Worm damage	30
Gumminess	15

Table 6

Almond seedling plantings

26-Jun-91

FILE = Almond1/91alm1 WEO Field F10 C and D

L O C A T I O N Planted on May 30 and 31,1991. Row-Tree 1-1 at NE corner; distance 3 ft.

New Order NW to E From	TO	Blk	Row	Old order NE to W From	TO	# of Sdlgs	CODE NO	P A R E N T S SEED	POLLEN	Notes	Notes according to old order NOTES
				Total		1866	T = Tall, M = medium, D = dwarf : TBN = terminal bud necrosis				
17	52	F10D	11	37	72	36	A90.113+118			Mix 113= NpIR x Ferragues,118=NpBF x Carmel	
15	22	F10D	12	67	74	8	A90.56	Tuono#1	Self		
47	87	F10C	1	1	41	41	A90.57	Nonpareil	F10C.12-28		
1	14	F10D	12	75	88	14	A90.57	Nonpareil	F10C.12-28		
37	46	F10C	1	42	51	10	A90.58	Mission	F10C.12-28		
27	36	F10C	1	52	61	10	A90.59	Mission	F10C.9-22		
42	43	F10C	2	45	46	2	A90.60	F10C.20-51	Self		M
29	30	F10C	2	58	59	2	A90.60	F10C.20-51	Self		M
14	28	F10C	2	60	74	15	A90.60	F10C.20-51	Self		EMPTY
49	87	F10C	2	1	39	39	A90.60	F10C.20-51	Self		
31	33	F10C	2	55	57	3	A90.60	F10C.20-51	Self		T
44	48	F10C	2	40	44	5	A90.60	F10C.20-51	Self		T
34	41	F10C	2	47	54	8	A90.60	F10C.20-51	Self		D
1	26	F10C	1	62	87	26	A90.61	Nonpareil	F10C.9-22		
7	13	F10C	2	75	81	7	A90.62	Nonpareil,BF	Carmel	Grayson(1)(8),114-3	
88	88	F10D	1	1	1	1	A90.63	WoodsColony	Butte	Delta plot,81	
67	87	F10D	1	2	22	21	A90.64	Nonpareil	Ferradual	Delta plot,Mc.R34T9	
58	66	F10D	1	23	31	9	A90.65	Fritz	Padre	Delta plot	
47	57	F10D	1	32	42	11	A90.66	Nonpareil	F7.12-6	Delta plot	
43	46	F10D	1	43	46	4	A90.67	WoodsColony	Nonpareil	Delta plot	
2	42	F10D	1	47	87	41	A90.68	Nonpareil	F10D.3.4-19		
88	88	F10D	2	1	1	1	A90.68	Nonpareil	F10D.3.4-19	Delta plot,R34T8	
86	87	F10D	2	2	3	2	A90.69	WoodsColony	Fritz	Delta plot	
61	65	F10D	2	24	28	5	A90.70	WoodsColony	Fritz	Delta plot	
51	60	F10D	2	29	38	10	A90.71	Padre	Monterey	Delta plot	
31	50	F10D	2	39	58	20	A90.72	Fritz	Monterey	Delta plot	
23	30	F10D	2	59	66	8	A90.73	Monterey	Padre	Delta plot	
1	1	F10D	1	88	88	1	A90.74	Nonpareil	F10D.1.2-9		
1	22	F10D	2	67	88	22	A90.74	Nonpareil	F10D,1,2-9	Delta plot,No #	
41	88	F10D	3	1	48	48	A90.75	Nonpareil	F10D.3.4-19	Delta plot,R34T9	
83	85	F10D	2	4	6	3	A90.76	WoodsColony	Monterey	Delta plot	
40	40	F10D	3	49	49	1	A90.77	WoodsColony	Butte	Delta plot	
1	39	F10D	3	50	88	39	A90.78	WoodsColony	Sonora	Delta plot	
87	88	F10D	4	1	2	2	A90.78	WoodsColony	Sonora		
84	86	F10D	4	3	5	3	A90.79	WoodsColony	Fritz	Delta plot	
75	83	F10D	4	6	14	9	A90.80	Padre	Fritz	Delta plot	
71	74	F10D	4	15	18	4	A90.81	Monterey	Padre	Delta plot	
56	70	F10D	4	19	33	15	A90.82	WoodsColony	Carmel	Delta plot	
22	55	F10D	4	34	67	34	A90.83	Carmel	Butte	Delta plot	
11	21	F10D	4	68	78	11	A90.84	WoodsColony	Carmel	Delta plot	
70	82	F10D	2	7	19	13	A90.85	WoodsColony	Nonpareil	Delta plot	
1	10	F10D	4	79	88	10	A90.86	WoodsColony	Monterey		
86	88	F10D	5	1	3	3	A90.86	WoodsColony	Monterey	Delta plot	
72	85	F10D	5	4	17	14	A90.87	WoodsColony	Carmel	Delta plot	
35	71	F10D	5	18	54	37	A90.88	Monterey	Sonora	Delta plot	
19	34	F10D	5	55	70	16	A90.89	Nonpareil	F10D.3-23	Delta plot,Mc.R34T4	
8	18	F10D	5	71	81	11	A90.90	Nonpareil	F10D.1,2-9	Delta plot,R34T10	
1	7	F10D	5	82	88	7	A90.91	Fritz	Sonora		
49	88	F10D	6	1	40	40	A90.91	Fritz	Sonora	Delta plot	
26	48	F10D	6	41	63	23	A90.92	Nonpareil	F7.12-5	Delta plot.R34T7	
6	25	F10D	6	64	83	20	A90.93	Nonpareil	Ferradual	Delta plot,Mc.R34T4	
1	5	F10D	6	84	88	5	A90.94	WoodsColony	Price		
84	88	F10D	7	1	5	5	A90.94	WoodsColony	Price	Delta plot	
74	83	F10D	7	6	15	10	A90.95	NonpareilIR	Ferragues	Delta plot,R42T7	
61	73	F10D	7	16	28	13	A90.96	NonpareilIR	Ferragues	Delta plot,R42T6	
40	60	F10D	7	29	49	21	A90.97	Nonpareil	F7,12-4	Delta plot,R34T6	
30	39	F10D	7	50	59	10	A90.98	Carmel	Fritz	Delta plot	
19	29	F10D	7	60	70	11	A90.99	Fritz	Monterey	Delta plot	
10	18	F10D	7	71	79	9	A90.100	Monterey	Nonpareil	Delta plot	
3	9	F10D	7	80	86	7	A90.101	Monterey	Nonpareil	Delta plot	
1	2	F10D	7	87	88	2	A90.102	Monterey	Fritz		
80	88	F10D	8	1	9	9	A90.102	Monterey	Fritz	Delta plot	
71	79	F10D	8	10	18	9	A90.103	Monterey	Fritz	Delta plot	
63	70	F10D	8	19	26	8	A90.104	Fritz	Padre	Delta plot	
60	62	F10D	8	27	29	3	A90.105	Padre	Fritz	Delta plot	
58	59	F10D	8	30	31	2	A90.106	WoodsColony	Butte	Delta plot	
40	57	F10D	8	32	49	18	A90.107	Fritz	Sonora	Delta plot	
30	39	F10D	8	50	59	10	A90.108	Monterey	Fritz	Delta plot	
66	69	F10D	2	20	23	4	A90.109	Monterey	Mission		
4	29	F10D	8	60	85	26	A90.109	Monterey	Mission	Delta plot	
1	3	F10D	8	86	88	3	A90.110	Monterey	Nonpareil	Delta plot	

FILE = Almond1/91alm1 WEO Field F10 C and D

L O C A T I O N Planted on May 30 and 31,1991. Row-Tree 1-1 at NE corner; distance 3 ft.

LOCATION New Order NW to E From	TO	Blk	Old order NE to W Row	From	TO	# of Sdlgs	CODE NO	P A R E N T S SEED	POLLEN	Notes	Notes according to old order NOTES
63	88	F10D	9	1	26	26	A90.110	Monterey	Nonpareil		
18	62	F10D	9	27	71	45	A90.111	Fritz	Carmel	Delta plot	
1	17	F10D	9	72	88	17	A90.112	Monterey	Sonora		
49	88	F10D	10	1	40	40	A90.112	Monterey	Sonora	Delta plot	
42	48	F10D	10	41	47	7	A90.113	Nonpareil,IR	Ferragues	Delta plot,R42T6	
1	41	F10D	10	48	88	41	A90.114	Monterey	Mission		
53	88	F10D	11	1	36	36	A90.114	Monterey	Mission	Delta plot,R42T2	
1	16	F10D	11	73	88	16	A90.115	Nonpareil,IR	Ferragues	Delta plot	
84	88	F10D	12	1	5	5	A90.115	Nonpareil,IR	Ferragues		
64	83	F10D	12	6	25	20	A90.116	Nonpareil,BF	Padre	Bud failure cross	
47	63	F10D	12	26	42	17	A90.117	Nonpareil,BF	1-69	Bud failure cross	
23	46	F10D	12	43	66	24	A90.119	Nonpareil,BF	Carmel,13-13	Bud failure cross	
1	3	F10C	6	85	87	3	A90.120	F10D,7-22	Self		D
34	34	F10C	6	54	54	1	A90.120	F10D,7-22	Self		T
4	5	F10C	6	83	84	2	A90.120	F10D,7-22	Self		M
33	33	F10C	6	55	55	1	A90.120	F10D,7-22	Self		D
12	13	F10C	6	75	76	2	A90.120	F10D,7-22	Self		D
32	32	F10C	6	56	56	1	A90.120	F10D,7-22	Self		M
11	11	F10C	6	77	77	1	A90.120	F10D,7-22	Self		M
30	31	F10C	6	57	58	2	A90.120	F10D,7-22	Self		D
49	50	F10C	6	38	39	2	A90.120	F10D,7-22	Self		T
29	29	F10C	6	59	59	1	A90.120	F10D,7-22	Self	PA selves	M
47	47	F10C	6	41	41	1	A90.120	F10D,7-22	Self		M
27	28	F10C	6	60	61	2	A90.120	F10D,7-22	Self		D
38	39	F10C	6	49	50	2	A90.120	F10D,7-22	Self		T
25	26	F10C	6	62	63	2	A90.120	F10D,7-22	Self		M
6	8	F10C	6	80	82	3	A90.120	F10D,7-22	Self		D
18	24	F10C	6	64	70	7	A90.120	F10D,7-22	Self		D
51	51	F10C	6	37	37	1	A90.120	F10D,7-22	Self		D
17	17	F10C	6	71	71	1	A90.120	F10D,7-22	Self		T
40	46	F10C	6	42	48	7	A90.120	F10D,7-22	Self		D
15	16	F10C	6	72	73	2	A90.120	F10D,7-22	Self		D
9	10	F10C	6	78	79	2	A90.120	F10D,7-22	Self		T
35	37	F10C	6	51	53	3	A90.120	F10D,7-22	Self		D
48	48	F10C	6	40	40	1	A90.120	F10D,7-22	Self		D
14	14	F10C	6	74	74	1	A90.120	F10D,7-22	Self		M
79	83	F10C	7	5	9	5	A90.120	F10D,7-22	Self		D
85	86	F10C	7	2	3	2	A90.120	F10D,7-22	Self		D
74	76	F10C	7	12	14	3	A90.120	F10D,7-22	Self		D
84	84	F10C	7	4	4	1	A90.120	F10D,7-22	Self		M
77	78	F10C	7	10	11	2	A90.120	F10D,7-22	Self		M
87	87	F10C	7	1	1	1	A90.120	F10D,7-22	Self		M
39	39	F10C	7	49	49	1	A90.121	F10D,8-23	Self		T
29	35	F10C	7	53	59	7	A90.121	F10D,8-23	Self		D
51	53	F10C	7	35	37	3	A90.121	F10D,8-23	Self		D
50	50	F10C	7	38	38	1	A90.121	F10D,8-23	Self		M(BRANCHY)
66	66	F10C	7	22	22	1	A90.121	F10D,8-23	Self		M
48	49	F10C	7	39	40	2	A90.121	F10D,8-23	Self		D
64	64	F10C	7	24	24	1	A90.121	F10D,8-23	Self		M
44	47	F10C	7	41	44	4	A90.121	F10D,8-23	Self		M
62	62	F10C	7	26	26	1	A90.121	F10D,8-23	Self		M
43	43	F10C	7	45	45	1	A90.121	F10D,8-23	Self		D
60	60	F10C	7	28	28	1	A90.121	F10D,8-23	Self		D
41	42	F10C	7	46	47	2	A90.121	F10D,8-23	Self		M
54	54	F10C	7	34	34	1	A90.121	F10D,8-23	Self		T
40	40	F10C	7	48	48	1	A90.121	F10D,8-23	Self		D
65	65	F10C	7	23	23	1	A90.121	F10D,8-23	Self		D
71	73	F10C	7	15	17	3	A90.121	F10D,8-23	Self		D
61	61	F10C	7	27	27	1	A90.121	F10D,8-23	Self		T
36	38	F10C	7	50	52	3	A90.121	F10D,8-23	Self		M
67	67	F10C	7	21	21	1	A90.121	F10D,8-23	Self		D
55	59	F10C	7	29	33	5	A90.121	F10D,8-23	Self		M
63	63	F10C	7	25	25	1	A90.121	F10D,8-23	Self		T
68	70	F10C	7	18	20	3	A90.121	F10D,8-23	Self	PA selves	M
1	1	F10C	7	87	87	1	A90.122	F10D,5-21	Self		M
17	17	F10C	7	71	71	1	A90.122	F10D,5-21	Self	PA selves	D
16	16	F10C	7	72	72	1	A90.122	F10D,5-21	Self		M
5	5	F10C	7	83	83	1	A90.122	F10D,5-21	Self		T
15	15	F10C	7	73	73	1	A90.122	F10D,5-21	Self		D
27	27	F10C	7	61	61	1	A90.122	F10D,5-21	Self		D
14	14	F10C	7	74	74	1	A90.122	F10D,5-21	Self		T
23	23	F10C	7	65	65	1	A90.122	F10D,5-21	Self		D

FILE = Almond1/91alm1 WEO Field F10 C and D

L O C A T I O N Planted on May 30 and 31,1991. Row-Tree 1-1 at NE corner: distance 3 ft.

New Order NW to E From	TO	Blk	Old order NE to W Row	From	TO	# of Sdlgs	CODE NO	P A R E N T S SEED	POLLEN	Notes	Notes according to old order NOTES
13	13	F10C	7	75	75	1	A90.122	F10D.5-21	Self		M
21	21	F10C	7	67	67	1	A90.122	F10D.5-21	Self		D
12	12	F10C	7	76	76	1	A90.122	F10D.5-21	Self		D
2	4	F10C	7	84	86	3	A90.122	F10D.5-21	Self		D
10	11	F10C	7	77	78	2	A90.122	F10D.5-21	Self		M
24	26	F10C	7	62	64	3	A90.122	F10D.5-21	Self		M
9	9	F10C	7	79	79	1	A90.122	F10D.5-21	Self		T
18	20	F10C	7	68	70	3	A90.122	F10D.5-21	Self		M
22	22	F10C	7	66	66	1	A90.122	F10D.5-21	Self		T
28	28	F10C	7	60	60	1	A90.122	F10D.5-21	Self		T
6	8	F10C	7	80	82	3	A90.122	F10D.5-21	Self		M
84	84	F10C	8	4	4	1	A90.122	F10D.5-21	Self		M
85	86	F10C	8	2	3	2	A90.122	F10D.5-21	Self		D
87	87	F10C	8	1	1	1	A90.122	F10D.5-21	Self		M
67	83	F10C	8	5	21	17	A90.123	F10D.5-17	Self	PA selves	
61	66	F10C	8	22	27	6	A90.124	F10D.5-20	Self	PA selves	TBN 24
57	60	F10C	8	28	31	4	A90.125	F10D.5-21	Self	PA selves	
43	43	F10C	8	45	45	1	A90.126	F10D.7-19	Self		T
45	45	F10C	8	43	43	1	A90.126	F10D.7-19	Self		M
56	56	F10C	8	32	32	1	A90.126	F10D.7-19	Self		D
44	44	F10C	8	44	44	1	A90.126	F10D.7-19	Self		D
50	51	F10C	8	37	38	2	A90.126	F10D.7-19	Self		M
54	55	F10C	8	33	34	2	A90.126	F10D.7-19	Self		M
48	48	F10C	8	40	40	1	A90.126	F10D.7-19	Self		M
42	42	F10C	8	46	46	1	A90.126	F10D.7-19	Self	PA selves	D
46	46	F10C	8	42	42	1	A90.126	F10D.7-19	Self		D
40	41	F10C	8	47	48	2	A90.126	F10D.7-19	Self		T
49	49	F10C	8	39	39	1	A90.126	F10D.7-19	Self		T
52	53	F10C	8	35	36	2	A90.126	F10D.7-19	Self		T
47	47	F10C	8	41	41	1	A90.126	F10D.7-19	Self		T
38	39	F10C	8	49	50	2	A90.126	F10D.7-19	Self		M
24	37	F10C	8	51	64	14	A90.127	F10D.5-19	Self	PA selves	
15	16	F10C	8	72	73	2	A90.128	F10D.5-16	Self		M
14	14	F10C	8	74	74	1	A90.128	F10D.5-16	Self	PA selves	D
23	23	F10C	8	65	65	1	A90.128	F10D.5-16	Self		T
13	13	F10C	8	75	75	1	A90.128	F10D.5-16	Self		M,TBN
19	20	F10C	8	68	69	2	A90.128	F10D.5-16	Self		M
11	12	F10C	8	76	77	2	A90.128	F10D.5-16	Self		T
17	17	F10C	8	71	71	1	A90.128	F10D.5-16	Self		T
2	10	F10C	8	78	86	9	A90.128	F10D.5-16	Self		M,TBN 85,86,81
21	22	F10C	8	66	67	2	A90.128	F10D.5-16	Self		D
1	1	F10C	8	87	87	1	A90.128	F10D.5-16	Self		D
18	18	F10C	8	70	70	1	A90.128	F10D.5-16	Self		D
85	87	F10C	9	1	3	3	A90.128	F10D.5-16	Self		D
14	14	F10C	9	74	74	1	A90.129	F10D.7-20	Self		M
23	24	F10C	9	64	65	2	A90.129	F10D.7-20	Self		D
68	70	F10C	9	18	20	3	A90.129	F10D.7-20	Self		D
1	3	F10C	9	85	87	3	A90.129	F10D.7-20	Self		M
25	26	F10C	9	62	63	2	A90.129	F10D.7-20	Self		M
6	6	F10C	9	82	82	1	A90.129	F10D.7-20	Self		T
66	67	F10C	9	21	22	2	A90.129	F10D.7-20	Self		T
81	82	F10C	9	6	7	2	A90.129	F10D.7-20	Self		M
27	41	F10C	9	47	61	15	A90.129	F10D.7-20	Self		D
15	15	F10C	9	73	73	1	A90.129	F10D.7-20	Self		D
63	65	F10C	9	23	25	3	A90.129	F10D.7-20	Self		M
16	16	F10C	9	72	72	1	A90.129	F10D.7-20	Self		T
42	43	F10C	9	45	46	2	A90.129	F10D.7-20	Self		T
17	17	F10C	9	71	71	1	A90.129	F10D.7-20	Self		M
62	62	F10C	9	26	26	1	A90.129	F10D.7-20	Self		D
18	18	F10C	9	70	70	1	A90.129	F10D.7-20	Self		T
61	61	F10C	9	27	27	1	A90.129	F10D.7-20	Self		T
72	76	F10C	9	12	16	5	A90.129	F10D.7-20	Self		D
57	60	F10C	9	28	31	4	A90.129	F10D.7-20	Self		D
22	22	F10C	9	66	66	1	A90.129	F10D.7-20	Self		M
56	56	F10C	9	32	32	1	A90.129	F10D.7-20	Self		T
4	5	F10C	9	83	84	2	A90.129	F10D.7-20	Self	PA selves	D
54	55	F10C	9	33	34	2	A90.129	F10D.7-20	Self		D
7	13	F10C	9	75	81	7	A90.129	F10D.7-20	Self		D
53	53	F10C	9	35	35	1	A90.129	F10D.7-20	Self		T
79	80	F10C	9	8	9	2	A90.129	F10D.7-20	Self		D
52	52	F10C	9	36	36	1	A90.129	F10D.7-20	Self		D
77	77	F10C	9	11	11	1	A90.129	F10D.7-20	Self		T

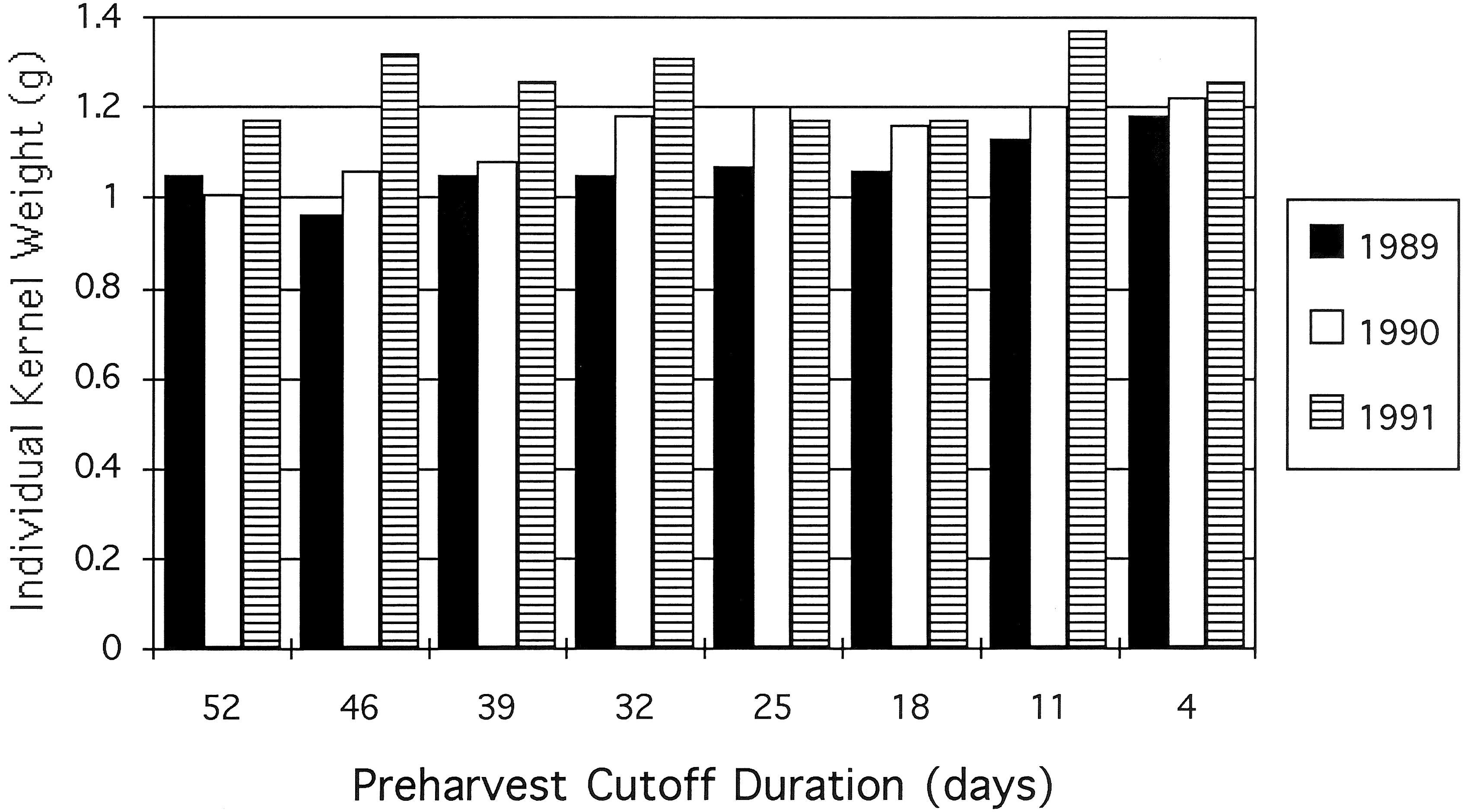


Figure 2. Non Pareil individual kernel weight (field dried) for the 8 preharvest cutoff regimes for each of the 3 experimental years.

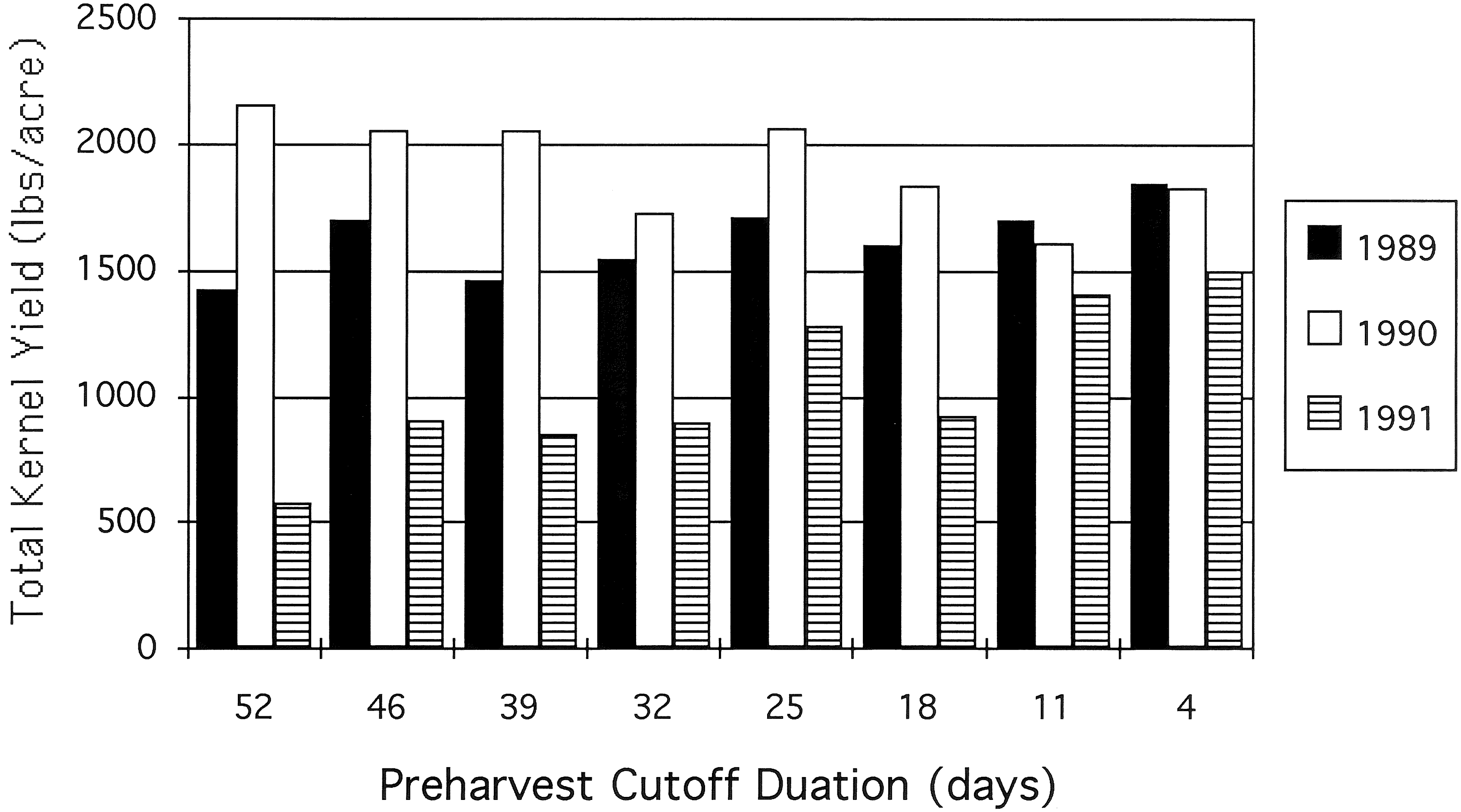


Figure 3. Non Pareil total kernel yield (field dried) for the 8 preharvest cutoff regimes for each of the 3 experimental years.

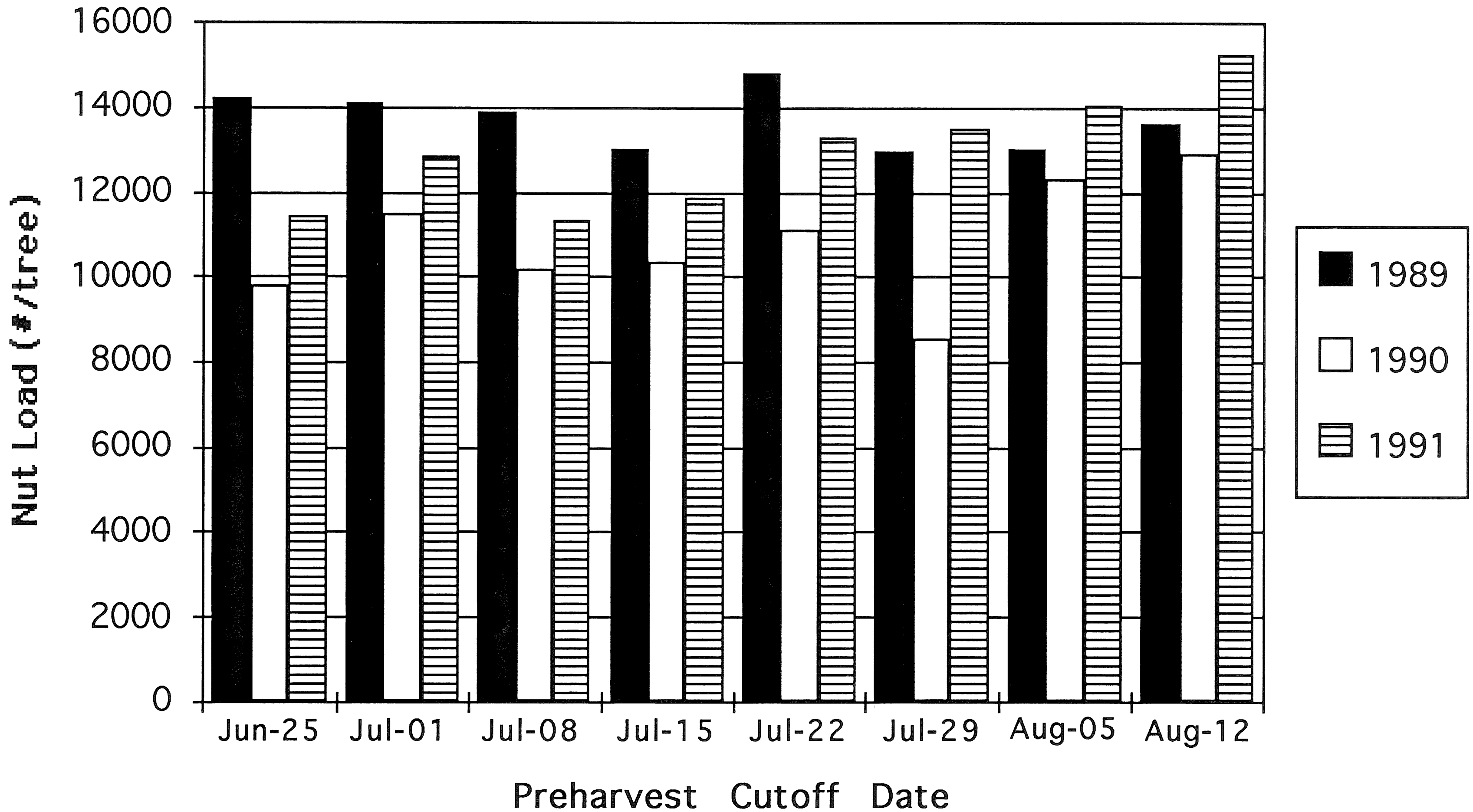


Figure 4. Carmel tree nut load for the 8 preharvest cutoff regimes for each of the 3 experimental years. All Carmel preharvest cutoff treatments received about 1.8 inches of water between the Non Pareil and Carmel harvests and also full postharvest irrigation.

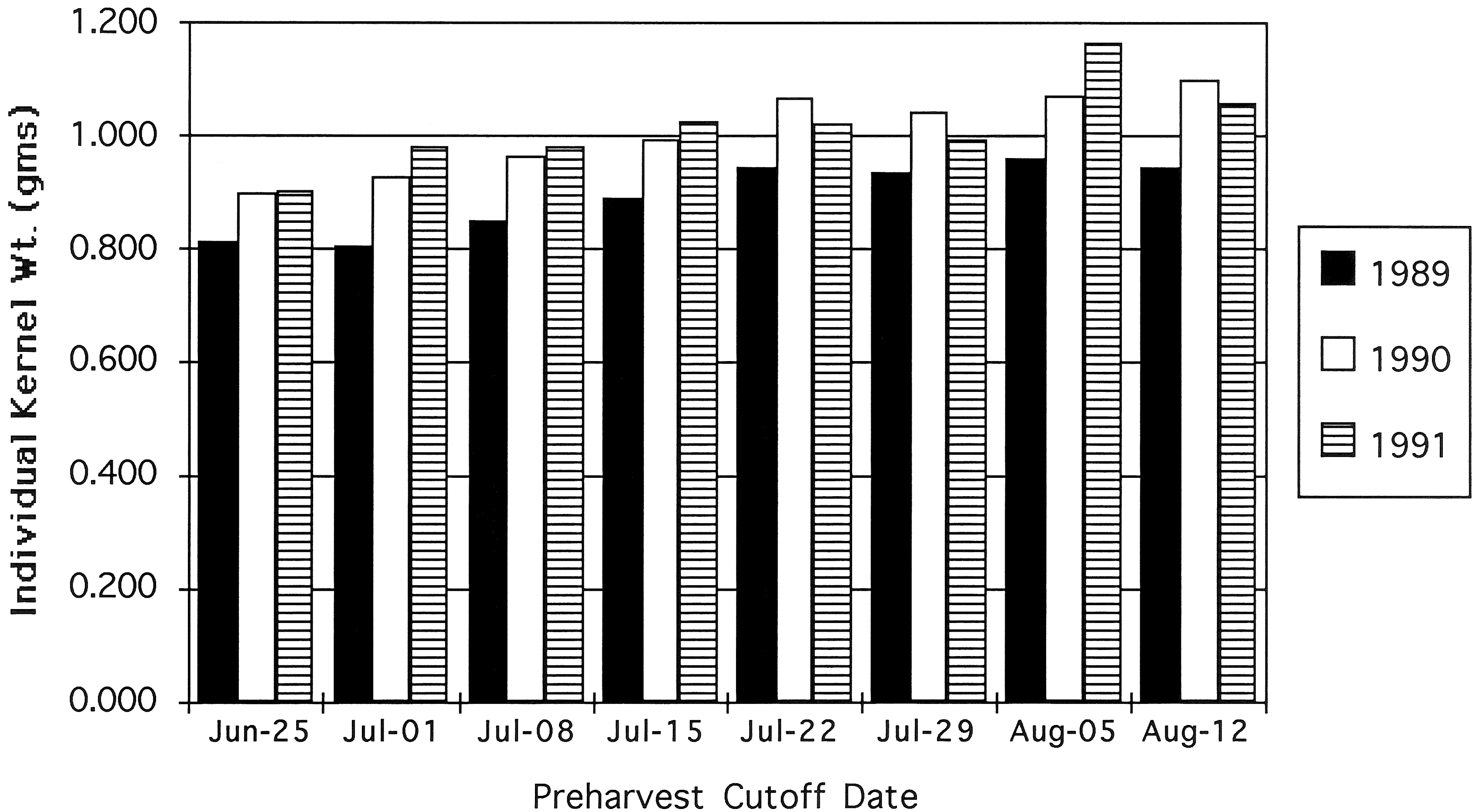


Figure 5. Carmel individual kernel weight (field dried) for the 8 preharvest cutoff regimes for each of the 3 experimental years.

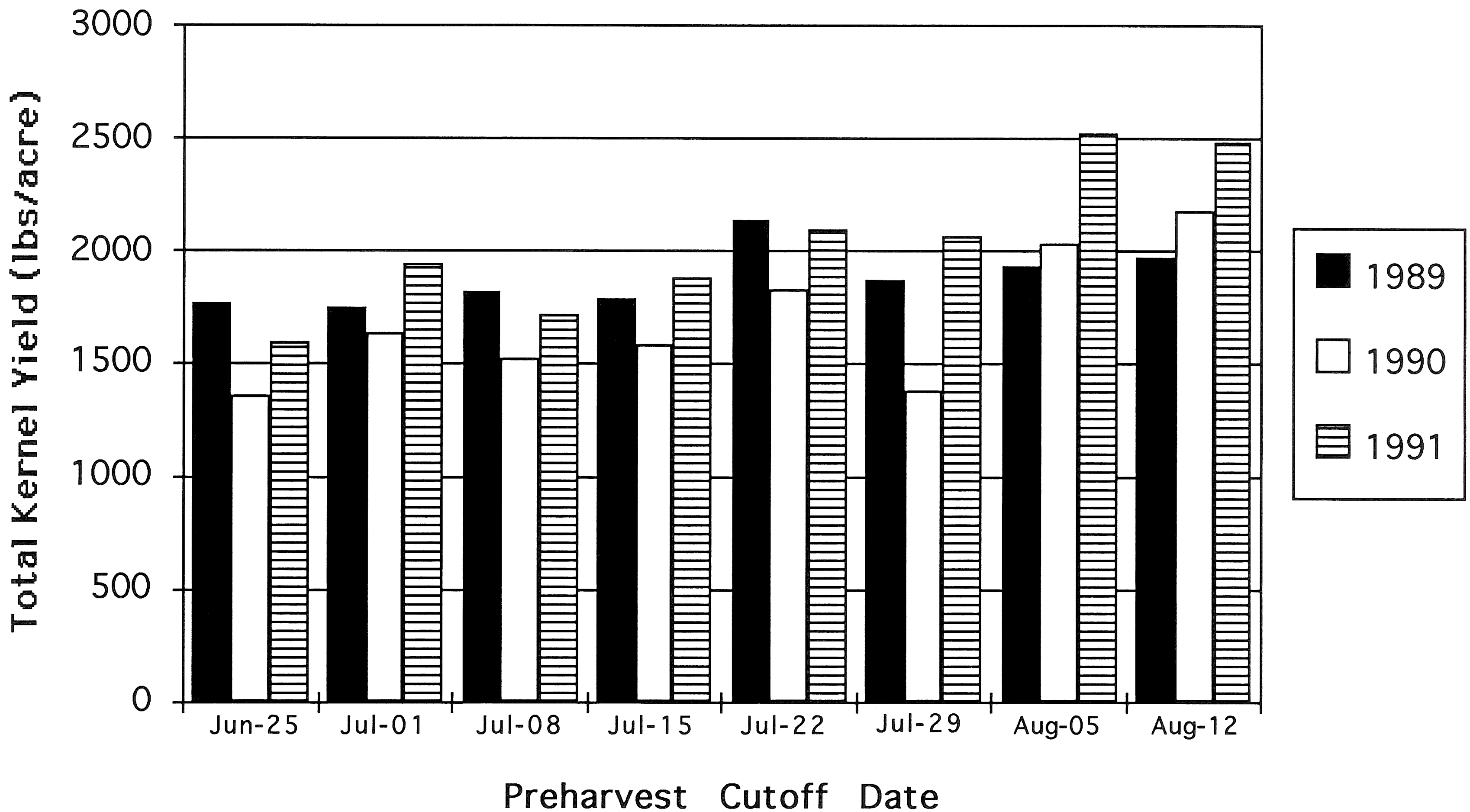


Figure 6. Carmel total kernel yield (field dried) for the 8 preharvest cutoff regimes for each of the 3 experimental years.

Table 6. Summary of Carmel <u>average</u> values (1989-91) for trunk growth and the primary yield components. All preharvest cutoff treatments received full postharvest irrigation in 1989 and 1990.

Treatment	Preharvest cutoff date	Cutoff duration (days)	Cumulative preharvest applied water (inches)	Increase in trunk cross-sectional area (cm2)	Nut load (#/tree)	Individual kernel weight (gm)	Total kernel yield (lb/acre)
1	Jun-25	64	19.3	41.7	11817 a	0.87 a	1573 a
2	Jul-01	58	21.1	46.8	13048 ab	0.91 ab	1814 ab
3	Jul-08	51	22.9	38.1	11797 a	0.93 bc	1680 a
4	Jul-15	44	24.7	43.5	11761 a	0.97 cd	1748 a
5	Jul-22	37	27.4	39.9	13450 ab	1.00 de	2056 bc
6	Jul-29	30	29.2	47	12108 ab	0.98 cde	1816 ab
7	Aug-05	23	31.0	55.4	13206 ab	1.07 f	2175 c
8	Aug-12	16	32.8	54.9	13919 b	1.03 ef	2209 c
				NSD			

Numbers not followed by the same letter are significantly different than others in the same column at the 5% confidence level using Duncan's multiple range test. NSD indicates no significant difference.

Table 7. Drought irrigation strategy experiment values for applied water, yield, and nut quality. Non Pareil trees were subjected to the 4 deficit irrigation regimes during a simulated drought in 1989 and returned to full irrigation in 1990 and 1991.

Year	Treatment	Water Applied through	Total * Water App. (inches)	Mean Kernel Yield (lbs/acre)	Mean Individual Kernel Wt (gms)	Mean Nut Load (#/tree)	Nut Quality: Full Hull Split (----% of tree nut load----)	Nut Quality: Partial Hull Split	Nut Quality: Hull Tight
1989	Control	Full Season	40.3	1476 a	1.24 a	7100 a	98.6 a	0.4 b	0.8 b
	Full ETc	Jun-19	16.1	1216 b	0.97 d	8160 a	38.3 b	48.1 a	13.7 a
	75% ETc	Jul-11	16.2	1103 b	1.10 bc	6340 a	85.3 a	11.4 b	3.4 b
	50% ETc	Aug-28	16.3	1293 ab	1.03 cd	7000 a	99.0 a	0.6 b	0.5 b
	CDI	Jul-31	16.0	1480 a	1.14 ab	7670 a	86.9 a	11.5 b	1.6 b
1990	'89 Control	Full Season	33.2	2437 a	1.04 a	12850 a	99.2 a	0.3 a	0.3 a
	'89 Full ETc	Full Season	32.9	813 e	1.03 a	4770 d	99.7 a	0.0 a	0.3 a
	'89 75% ETc	Full Season	32.9	1333 d	0.99 a	8250 c	99.9 a	0.0 a	0.1 a
	'89 50% ETc	Full Season	33.3	1794 b	0.89 a	11690 ab	99.6 a	0.0 a	0.4 a
	'89 CDI	Full Season	32.8	1584 c	0.96 a	9080 bc	99.6 a	0.0 a	0.3 a
1991	'89 Control	Full Season	33.0	2105 b	0.97 a	9890 b	98.3 a	1.3 a	0.4 a
	'89 Full ETc	Full Season	33.0	2077 b	1.02 a	9200 b	98.8 a	0.7 a	0.6 a
	'89 75% ETc	Full Season	33.0	1763 a	1.02 a	7900 a	97.9 a	1.2 a	0.9 a
	'89 50% ETc	Full Season	33.0	1740 a	1.13 b	7050 a	98.5 a	1.0 a	0.5 a
	'89 CDI	Full Season	33.0	1877 ab	1.07 ab	7620 a	98.7 a	0.5 a	0.9 a
3 Year Mean	'89 Control		35.5	2006	1.08	9947	98.7	0.7	0.5
	'89 Full ETc		27.3	1369	1.01	7377	78.9	16.3	4.9
	'89 75% ETc		27.4	1400	1.04	7497	94.4	4.2	1.5
	'89 50% ETc		27.5	1609	1.02	8580	99.0	0.5	0.5
	'89 CDI		27.3	1647	1.06	8123	95.1	4.0	0.9

* Does not include 4.2 inch pre-irrigation.

Numbers not followed by the same letter are significantly different than others in the same column at the 5% confidence level using Duncan's multiple range test. NSD indicates no significant difference.

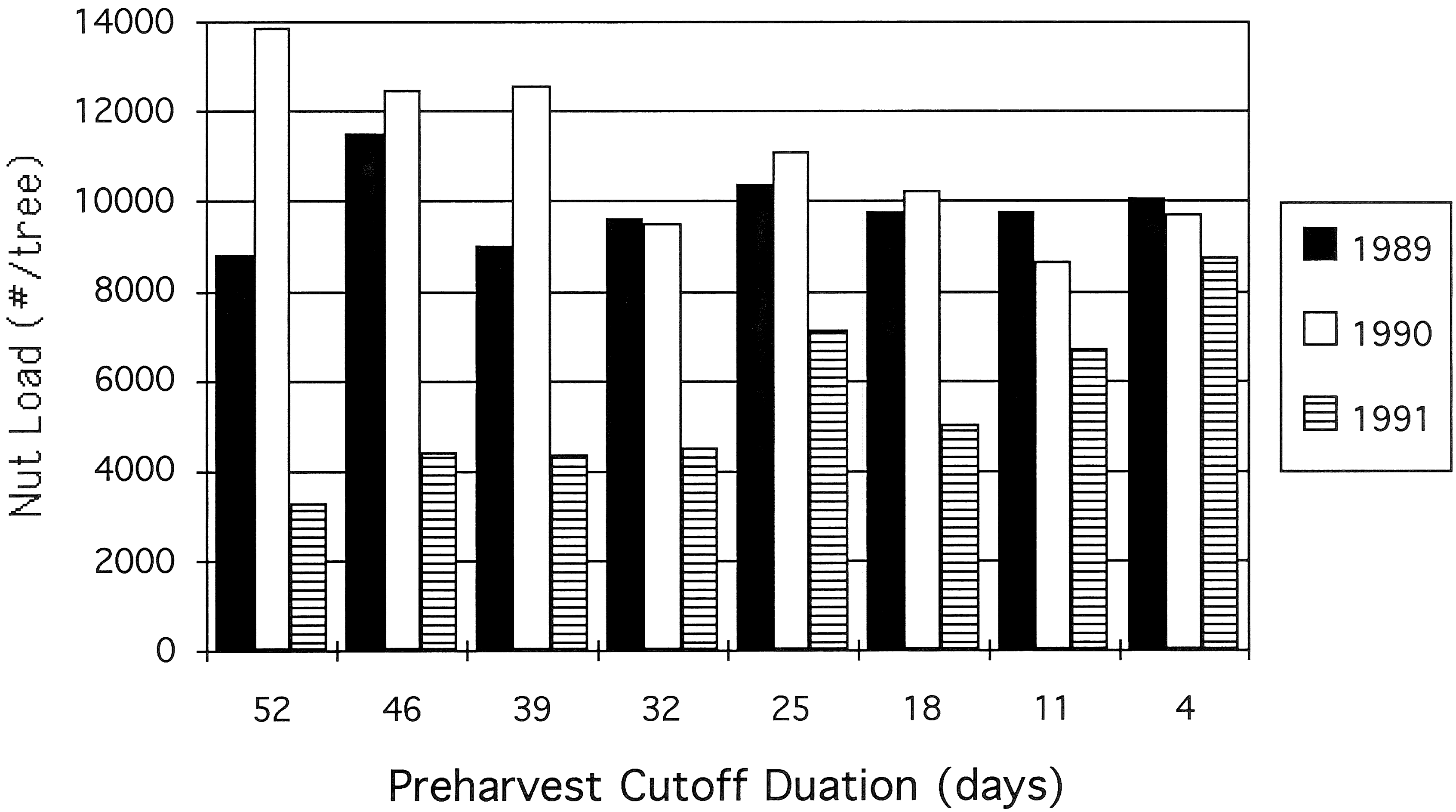


Figure 1. Non Pareil tree nut load for the 8 preharvest cutoff regimes for each of the 3 experimental years. All preharvest cutoff treatments received full postharvest irrigation.

FILE = Almond1/91alm1 WEO Field F10 C and D

L O C A T I O N Planted on May 30 and 31,1991. Row-Tree 1-1 at NE corner; distance 3 ft.

New Order NW to E From	TO	Blk	Old order NE to W Row	From	TO	# of Sdlgs	CODE NO	P A R E N T S SEED	POLLEN	Notes	Notes according to old order NOTES
50	51	F10C	9	37	38	2	A90.129	F10D.7-20	Self		T
21	21	F10C	9	67	67	1	A90.129	F10D.7-20	Self		T
48	49	F10C	9	39	40	2	A90.129	F10D.7-20	Self		D
83	84	F10C	9	4	5	2	A90.129	F10D.7-20	Self		D
47	47	F10C	9	41	41	1	A90.129	F10D.7-20	Self		M
78	78	F10C	9	10	10	1	A90.129	F10D.7-20	Self		M
46	46	F10C	9	42	42	1	A90.129	F10D.7-20	Self		D
71	71	F10C	9	17	17	1	A90.129	F10D.7-20	Self		M
19	20	F10C	9	68	69	2	A90.129	F10D.7-20	Self		D
44	44	F10C	9	44	44	1	A90.129	F10D.7-20	Self		D
45	45	F10C	9	43	43	1	A90.129	F10D.7-20	Self		M
85	85	F10C	10	3	3	1	A90.129	F10D.7-20	Self		T
79	79	F10C	10	9	9	1	A90.129	F10D.7-20	Self		D
80	80	F10C	10	8	8	1	A90.129	F10D.7-20	Self		T
67	65	F10C	10	21	23	3	A90.129	F10D.7-20	Self		T
81	81	F10C	10	7	7	1	A90.129	F10D.7-20	Self		D
70	69	F10C	10	18	19	2	A90.129	F10D.7-20	Self		T
82	82	F10C	10	6	6	1	A90.129	F10D.7-20	Self		M
72	72	F10C	10	16	16	1	A90.129	F10D.7-20	Self		M
84	83	F10C	10	4	5	2	A90.129	F10D.7-20	Self		D
77	77	F10C	10	11	11	1	A90.129	F10D.7-20	Self		T
86	86	F10C	10	2	2	1	A90.129	F10D.7-20	Self		D
64	64	F10C	10	24	24	1	A90.129	F10D.7-20	Self		D
87	87	F10C	10	1	1	1	A90.129	F10D.7-20	Self		T
71	71	F10C	10	17	17	1	A90.129	F10D.7-20	Self		D
78	78	F10C	10	10	10	1	A90.129	F10D.7-20	Self		M
68	68	F10C	10	20	20	1	A90.129	F10D.7-20	Self		M
76	73	F10C	10	12	15	4	A90.129	F10D.7-20	Self		D
63	62	F10C	10	25	26	2	A90.130	F10D.3-14	Self	PA selves	T
61	61	F10C	10	27	27	1	A90.131	F10D.4-14	Self	PA selves	D
60	60	F10C	10	28	28	1	A90.132	F10D.3-23	Self	PA selves	T
5	6	F10C	2	82	83	2	A90.149	Nonpareil,BF	Fritz,Wells,1W-23N	Bud-failure,bags	
1	4	F10C	2	84	87	4	A90.150	Nonpareil,BF	Fritz,Wells,1-23(3)		TBN 87
81	87	F10C	3	1	7	7	A90.150	Nonpareil,BF	Fritz,Wells,1-23(3)		TBN 2
57	80	F10C	4	7	30	24	A90.150	Nonpareil,BF	Fritz,Wells,1-23(3)	Bud-failure,bags	TBN 13,21,27
27	56	F10C	4	31	60	30	A90.151	Nonpareil,BF	Jordanola	Bud-failure,bags	TBN 38,52,53,58
22	26	F10C	4	61	65	5	A90.152	Nonpareil,BF	Mission,(2)	Bud-failure,bags	
1	21	F10C	4	66	86	21	A90.153	Nonpareil,BF	Monterey,55-1(2)		TBN 68-70,72,73
75	87	F10C	5	1	13	13	A90.153	Nonpareil,BF	Monterey,55-1(2)	Bud-failure,bags	TBN 3,4
55	74	F10C	5	14	33	20	A90.154	Nonpareil,BF	Monterey,55-2(2)	Bud-failure,bags	TBN,14,26,32,33
46	80	F10C	3	8	42	35	A90.155	Nonpareil,BF	Monterey,55-4(2)	Bud-failure,bags	TBN 26,27,40
51	54	F10C	5	34	37	4	A90.155	Nonpareil,BF	Monterey,55-4(2)		TBN 36
21	45	F10C	3	43	67	25	A90.156	Nonpareil,BF	Padre,(2)	Bud-failure,bags	TBN 62
1	20	F10C	3	68	87	20	A90.157	Nonpareil,BF	Padre,(3)		TBN 72
81	86	F10C	4	1	6	6	A90.157	Nonpareil,BF	Padre,(3)	Bud-failure,bags	
35	50	F10C	5	38	53	16	A90.158	Nonpareil,BF	Price,Fowlers(2)	Bud-failure,bags	TBN 42
1	34	F10C	5	54	87	34	A90.159	Nonpareil,BF	Price,SierraGold		TBN 55,58.67,71.72,79.80.84,85.87
82	87	F10C	6	1	6	6	A90.159	Nonpareil,BF	Price,SierraGold	Bud-failure,bags	TBN 1-3
52	81	F10C	6	7	36	30	A90.160	Nonpareil,BF	Price,SierraGold(3)	Bud-failure,bags	TBN 9-11,17,31-33,35

Table ? . Descriptors to characterize almond traits
This list is based upon terms and classes approved at GREMPA meeting in (Dokozu and) Some modification and additional reference genotypes included.

I. Tree characteristics

Tree size

	Term	feet	interval	mean	cultivar
1	dwarfed (1 meter or less),	< 3	3		
3	small (1 to 2 meters),	3 - 7.5	4.5	(5.5)	
5	medium (2 to 5 meters),	7.5 - 15	7	(11.5)	Merced
7	large (5 to 8 meters)	15 - 25	10	(20)	Nonpareil
9	very large (>8 meters).	> 25	indef		

Tree Shape

1	Extremely upright	Bartre, Davey
3	Upright	Texas (Mission), Ferranges
5	Medium	Nonpareil
7	Spreading	Drake
9	Drooping	Ai, Desmayo

Tree Vigor

3	Weak	Marcona
5	Intermediate	Nonpareil
7	Strong	Fleur en bas

Branching (ramification).

1	Absent or low	Bartre
3	Sparse	Texas (Mission)
5	Intermediate	Desmayo Largueta, Nonpareil
7	Dense	Marcona, Jordanolo
9	Extremely dense	Ai

Growth habit (location of flower buds)

1	Most flower buds on one year old shoots	Ai
2.	Most flower buds on spurs	Tuono
c.	Mixed. Combination of long shoots and spurs	

Tendency in biennial bearing

3	Weak	Nonpareil
5	intermediate	Marcona
7	Strong	Rachele

Precocity of bearing

1	Extremely low	Fleur en bas

3	Low	Bartre
5	Intermediate	Nonpareil
7	High	Marcona

<u>Foliage density</u>

3	Low	Nonpareil
5	Intermediate	Texas (Mission)
7	Dense	Jordanolo

<u>Coloration of shoot tip</u>

0	no anthocyanin	
3	Low	Desmayo Largueta
5	Intermediate	Bartre
7	Strong	Texas (Mission)

II. Reproduction

<u>Time of flowering</u>

1. Extremely early	Cavaliera, Harriott (Cal.)
2. Very early	Desmaya Largueta, Jordanolo
3. Early	Ne Plus Ultra
4. Early/intermediate	Peerless (Cal)
5. Intermediate	Nonpareil
6. Intermediate/Late	Drake, Butte (Cal)
7. Late	Texas (Mission)
8. Very Late	Ferragnes, Ruby
9. Extremely Late	Tardy Nonpareil

<u>Tree chilling requirement</u>

1	extremely low	
3	Low	Marcona
5	Medium	Texas, Primorskyi
7	High	Tuono, Filippo Ceo
9	Extremely high	Cristomorto, Ferragnes

<u>Heat requirement for flower bud emergence</u>

1	extremely	
3	Low	Tuono, Filippo ceo
5	Medium	Desmayo, Ne Plus Ultra
7	High	Nonpareil, Marcona
9	Extremely high	Rachele, Primorskyi

<u>Color of petals</u>

1	white	Bartre
3	light pink	AI, Nonpareil
5	pink	Marcona

<u>Double Flowers per bud</u>

3	few
5	intermediate
7	many

Pistils per flower

1	one	Nonpareil
2	one to two	Desmayo Largueta
3	two	
4	one to three	
5	many	

III. Nut maturity

Time of Maturity

1	Extremely early	Cavalier, Kapareil
3	Early	Nonpareil
5	Medium	Ferragnes, Ne Plus Ultra
7	Late	Marcona, Carmel (Cal)
9	Very Late	Texas (Mission)

Method of splitting

1	Suture only	Nonpareil
3.	2-way split	
5	4-way split	

Ease of nut removal

3	low
5	intermediate
7	high

Ease of hulling

3	low
5	intermediate
7	high

IV. fruit and nut characters

Shell Hardness

	Class	Description	correlated shelling %	Cultivar
1	Extremely hard	Needs hammer to break.	<30%	Bartre, Marcona
3	Hard	Needs hammer	30 to 40%	Desmayo Larguetta
5	Semi-hard	Sometimes broken by hand with effort	40 to 50%	Texas (Mission)
7	Soft	Broken by hand	50 to 60%	Princesse, Ne Plus Ultra
9	Paper	Very thin	>60%	Nonpareil

Size of hull

1	thin hull	Texas (Mission)
3	intermediate	Nonpareil
5	thick	Vesta

<u>Nut size</u>

1	very small	
3	small	Texas (Mission)
5	medium	Nonpareil
7	large	Ardechoise, Ne Plus Ultra
9	extremely large	Bartre

<u>Shape of nut</u>

1.	round	Marcona
2	ovate	Texas (Mission)
3	oblong	Ai
4	cordate	Cristomorto, Nonpareil
5	narrow	Ne Plus Ultra, Jordanolo

<u>Color intensity of shell</u>

1	extremely light	Abiod
3	light	Peerless
5	intermediate	
7	dark	Marcona

<u>Markings on Nut</u>

0 without pores
1 Sparsely pored - rounded holes penetrating the shell
3 intermediate
5 densely pored
7 scribed and pored
9 scribed - vertical grooves in the surface

<u>Suture opening</u>

1 no opening at the suture
5 slightly open (
9 very wide

<u>Shell integrity</u>

1 All retained
5 partly missing
9 all missing

<u>Kernel size</u>

2	very small	< 40/ounce	some wild species
3	small	30-40/ounce	Kapareil, Padre
4	small-medium	25-30/ounce	Texas (Mission),
5	medium	20-25/ounce	Nonpareil
7	large	15-20/ounce	Ne Plus Ultra
9	very large	> 15/ounce	Bartre

<u>Kernel shape</u>

oblong	uniform width
oval	widest half way between tip and base
obovate	widest near base
wedge	widest at base, tapering sharply toward apex

Width/length ratio: (W/L x 100)

1	<45	narrow	Jordanolo
3	45-50	elongated	Ne Plus Ultra
5	50-55	medium	Nonpareil
7	55-60	wide	Merced
9	>60	very wide	Texas (Mission), Marcona

Thickness

3	7.0 - 8.0 mm	thin	Kapareil
5	8.0 - 8.5 mm	medium	Nonpareil
7	8.5 - 9.0 mm	plump	Merced
9	> 9.0 mm	very plump	Texas (Mission)

Color intensity

1	Extremely light	
3	Light	Nonpareil
5	Intermediate	Ne Plus Ultra
7	Dark	Texas (Mission)
9	Extremely dark	Fournat de Brezenaud

Wrinkling of kernel

3	slightly wrinkled	Nonpareil
5	intermediate	Ne Plus Ultra
7	wrinkled	

Texture (smoothness) of kernel surface

3	Low	Nonpareil
5	Intermediate	Desmayo, Carmel
7	High	Ferragnes, Ne Plus Ultra
9	Extremely high	Ardechoise

Kernel taste

3	Sweet	Nonpareil
5	Intermediate	Texas (Mission)
9	Bitter	

TABLE 8 Evaluation Schedule — Field and Marketing Characteristics of Eleven Almond Varieties

*Characteristics**	Nonpareil	Merced	Mission	Peerless	NePlus Ultra	Butte	Carmel	Fritz	Price Cluster	Ruby	Thompson
A. TREE CHARACTERISTICS											
1. Potential productivity (1-10)	8	7	7	6	7	8	8	7	7	7	8
2. Pruning and training (1-5)	4	3	5	4	2	4	4	4	4	4	4
3. Early production (precocity) (1-5)	3	5	4	3	4	4	5	3	3	3	4
4. Consistency of bearing (1-5)	4	3	4	4	3	4	4	4	3	3	4
5. Uniformity and rapidity of ripening (1-5)	4	2	3	4	3	4	4	3	4	4	3
6. Ease of knocking (1-5)	4	1	3	5	4	3	4	4	4	4	1
7. Ease of hulling (1-5)	3	2	4	1	3	3	3	3	3	3	3
8. Shell seal (1-5)	2	2	5	5	3	3	3	3	2	5	2
Subtotal — A. Tree Characteristics (45)	32	25	35	32	29	33	35	32	30	33	29
B. TREE AND NUT RESISTANCES											
9. Bud failure (BF) (1-5)	3	2	5	4	5	5	4	5	5	5	4
10. Limb breakage (1-5)	2	4	5	4	3	4	2	4	4	4	4
11. Frost (blossoms) (1-5)	5	3	3	2	3	3†	3†	3†	3†	3†	3†
12. Freedom from gummy nuts and corky-growth (1-5)	5	2	3	5	3	4	4	4	4	4	1
13. Salt injury (1-5)	4	2	1	4	3	3†	3†	3†	3†	3†	2†
14. Herbicide injury (1-5)	5	3	2	4	5	3†	3†	3†	3†	3†	3†
15. Worm damage (1-10)	4	2	10	10	6	8	9	5	6	8	3
16. Mites (1-5)	2	2	4	3	2	2	3	2	3	3	3
17. Brown rot (1-5)	4	3	3	3	2	2	2	3	4	2	3
18. Shot hole (1-5)	2	2	3	2	1	3	3	3	3	3	2
19. Hull rot (1-5)	2	2	5	4	3	3†	3†	3†	3†	3†	3†
20. Crown rot (*Phytophthora*) (1-5)	2	2	4	2	2	2†	2†	2†	2†	2†	2†
21. Verticillium wilt (1-5)	3	4	4	3	3	3†	2	3†	3†	3†	3†
22. *Ceratocystis* (1-5)	2	3	1	3	3	3†	3†	3†	3†	3†	2†
Subtotal — B. Tree and Nut Resistances (75)	45	36	53	54	44	48	46	46	49	49	38
C. NUT CHARACTERISTICS — RAW PRODUCT											
I. SHELLED NATURAL											
1. General appearance (1-10)	10	7	6	7	5	7	7	6	7	6	8
2. Color (lightness) (1-5)	5	3	2	3	2	2	3	2	3	3	4
3. Freedom from doubles (1-10)	10	8	4	6	4	9	9	6	5	7	8
4. Freedom from shrivels and deformity (1-5)	4	3	3	3	2	3	3	2	3	3	4
5. Smoothness (1-5)	5	4	3	3	3	3	4	3	4	3	4
6. Resistance to machine damage (1-5)	5	4	2	1	4	3	4	3	4	3	4
7. Raw flavor (1-5)	4	3	4	1	2	3	3	3	3	4	4
8. Ability to go into major market classes (1-5)											
a. Nonpareil	5										
b. California group		5		4	3	1	3	2	4	1	5
c. Mission			5			4		1		3	
9. Special use (1-3)											
a. Long kernels	1				1		1				
b. Flat kernels	1										
c. Extra large	1	1			1						
d. Extra small			1			1		1			
II. INSHELL											
10. Inshell (1-10)	1	1	5	8	4	4	5	2	1	2	1
Subtotal — C. Nut Characteristics — Raw Product (63)	52	39	35	36	31	40	42	31	34	35	42
D. NUT CHARACTERISTICS — PROCESSED PRODUCT											
III. BLANCHED											
11. Ease of blanching (1-10)	10	8	1	7	7	6	6	7	8	4	10
12. Splits (1-5)	5	4	1	4	3	2	2	2	4	3	4
13. Slivered (1-5)	5	3	1	4	3	2	2	2	3	3	3
14. Color (whiteness) (1-5)	3	3	1	3	3	2	3	3	3	3	4
IV. MANUFACTURING STOCK											
15. Slicing (1-5)	5	4	2	3	3	3	3	3	4	3	4
16. Flavor — roasted (1-5)	3	4	5	3	2	4	4	3	3	3	4
17. Appearance — roasted (1-5)	5	3	4	3	2	4	3	3	3	4	4
18. Salt/flavor adherence (1-5)	2	3	5	3	3	4	2	3	2	2	3
Subtotal — D. Nut Characteristics — Processed Product (45)	38	32	20	30	26	27	25	26	30	25	36
Total Field (120)	**77**	**61**	**88**	**86**	**73**	**81**	**81**	**78**	**79**	**82**	**67**
Total Marketing (108)	**90**	**71**	**55**	**66**	**57**	**67**	**67**	**57**	**64**	**60**	**78**
GRAND TOTAL (228)	**167**	**132**	**143**	**152**	**130**	**148**	**148**	**135**	**143**	**142**	**145**

*The higher the rating, on a scale of 1 to 3, 1 to 5, or 1 to 10, the better the variety's performance.
†Estimated.

Table 9

ALMOND VARIETY EVALUATION SCHEDULE - DESCRIPTION OF TERMS

A. NUT CHARACTERISTICS

RATING SCHEDULE - MARKETING

I. SHELLED NATURAL - Kernels after the shells are removed and before processing.

1. General Appearance 1-10 - General attractiveness based on color, uniformity and symmetry of shape with Nonpareil used as the standard.

2. Color (Lightness) 1-5 - Colors of skin (pellicle) range from light (as Nonpareil) to very dark. In general "lightness" is given highest ratings. This category does not measure actual color, but desirability of color.

3. Freedom from Doubles 1-10 - Double Kernels - Two kernels within one nut and which are usually misshapen. Varietal characteristic but also varies by year and location. Less than 5% considered OK; higher than 20% considered very bad.

4. Freedom from Shrivels and Deformity 1-5 - Kernels should have uniform surface and shape and should be completely filled.

5. Smoothness 1-5 - Refers to absence of small pubescent hairs or roughness of outer surface of skin.

6. Resistance to Machine Damage 1-5 - Shelling damages some kinds of nuts particularly those with harder shells. Produces "chipped" and "broken".

7. Raw Flavor 1-5 - Subjective evaluation for taste.

8. Ability to go into Major Market Classes 1-5 - Almond kernels generally are grouped for handling into three major categories: Nonpareil, California, Mission. To go into Nonpareil, kernels must be indistinguishable in color and shape. Mission kernels are thick and broad and are handled principally as unblanched, roasted and salted nuts. The California group includes nuts of a large number of varieties used primarily for processing. This group includes Merced, Thompson, Carmel, Price and Davey. Shape is intermediate between Nonpareil and Mission and kernels must be blanchable.

9. Special Use 1-3 - Certain size and shape categories outside the usual range of kernels have special but somewhat limited use.

   Long Kernels = width/length ratios of 40-50%

   Flat Kernels = screen size 22/64 or less

   Extra Large = 16-18 kernels/oz or less

   Extra Small = 30 kernels/oz or more

If nuts fall into any of these categories, one point only is given per category.

II. IN-SHELL

10. In-Shell 1-10 - Special use as in-shell variety. Must have firm, smooth shell that is bleachable. Peerless is the major variety produced specially for the in-shell market and generally commands a premium over its actual kernel content. Since the in-shell market is limited, heavy production of an in-shell variety likely would bring its value down to its meat content. Factors to be considered in evaluating varieties for in-shell use are as follows:

    Uniformity

    Brightness (ability to bleach)

    Large Size

    Outer Cork Firmness (ability to be handled without damaging outer cork)

    Freedom from Internal Defects

III. BLANCHED - Standard commercial treatment for blanching is a combination of hot water and steam to loosen the skins (pellicle) followed by passing the almonds through a series of soft rubber rollers to remove skins. Home blanching normally is done using hot water with skins removed by hand.

11. Ease of Blanching 1-10 - Ability of the skins to be removed during blanching treatment.

12. Splits 1-5 - Ability of the kernels to be mechanically split into two natural halves.

13. Slivered 1-5 - Ability of the kernels to be cut into slivers.

14. Color (Whiteness) 1-5 - Whiteness of kernel after blanching.

IV. MANUFACTURING STOCK - Unblanched kernels to be used for roasting, blanching, slicing, chopping, grinding or milling.

15. Slicing 1-5 - Ability of kernels to be cut into slices.

16. Flavor-Roasted 1-5 - Subjective evaluation after roasting.

17. Appearance-Roasted 1-5 - Subjective evaluation.

18. Salt Flavor Adherence 1-5 - Ability of kernels to retain salt additives after roasting.

B. FIELD CHARACTERISTICS

RATING SCHEDULE - FIELD

I. TREE CHARACTERISTICS

1. Potential Productivity 1-10 - Rating for potential productivity based on yield (kernel pounds per acre) under favorable pollination conditions.

2. Resistance to Bud Failure (BF) 1-5 - Current probability of the variety to develop BF based on previous experience in the field. Must be interpreted carefully and subject to constant review. Depends also on progress in selecting and utilizing low-BF "strains" of certain varieties.

3. Pruning and Training 1-5 - Ease of producing good framework and maintaining productivity with a minimum of pruning. In general easier with a tree somewhat upright and without excess branching.

4. Early Production (precocity) 1-5 - Ability to come into bearing at an early age.

5. Consistency of Bearing 1-5 - Annual production without alternate bearing. Does not include frost, disease damage and other environmental factors.

6. Resistance to Limb Breakage 1-5 - Strength of main scaffolds in holding large crops without splitting the trunk or breaking limbs.

7. Blossom Resistance to Frost 1-5 - Ability of blossoms to resist below freezing temperatures at a given stage of bloom. Does not include time of bloom in the overall ability to resist frost damage.

8. Freedom from Gummy Nuts and Corky-growth 1-5 - Includes any condition that results in gum pockets within shell and kernel - refers primarily to the problems of "split-pit" associated with high vigor, large size nuts that develop before shell-hardness in May. "Corky-growth" is callus growth that develops from the inside of a split shell in May and then adheres to kernel.

9. Resistance to Salt Injury 1-5 - Salt (sodium and/or chloride) measured by symptoms (tip-burn), reduced growth and leaf analysis.

10. Resistance to Herbicide Injury 1-5 - Production of symptoms and damage to trees.

II. HARVEST CHARACTERISTICS

11. Uniformity and rapidity of Ripening 1-5 - Nuts ripen by splitting (dehiscence) of the hulls, loosening of the attachment to the fruit stem (abscission) and drying (dehydration) of hull. Begins on tip of branches and proceeds inward. Refers to the overall rapidity and uniformity of this entire process from first split to time when nuts can be removed.

12. Ease of Knocking 1-5 - Refers to the ability of the nuts to be easily and completely knocked from the tree without leaving nuts within the tree.

13. Ease of Hulling 1-3 - Refers to ability of the hulls to be removed and separated from the in-shell nuts.

14. Shell Seal 1-5 - Refers to the tightness of the shell at the suture line.

III. RESISTANCE

RESISTANCE - All of the resistance factors are based on relative potential resistance (degree of severity of symptoms) and not on current distribution of the problem. Future field experience and controlled tests will be included as information is available.

15. Worm Damage 1-10 - Relative ability to resist the attack of navel orangeworm and twig borer. Primarily a factor of shell seal and hardness but may also include factors of ripening patterns and hull resistance.

16. Mites 1-5 - Resistance to spider mites involves the relative ability to sustain mite populations without appreciable defoliation; or exhibit lack of feeding preferences; or reduced population development.

17. Brown Rot 1-5 - Refers to degrees of blossom and twig blight caused by *Monilinia laxa*.

18. Shot Hole 1-5 - Judged on leaf infections followed by defoliation and hull infections caused by Coryneum.

19. Hull Rot 1-5 - Ratings are based on hull infection by *Rhizopus* and *Monilinia* species causing shoot blight and sticktights.

20. Crown Rot (*Phytophthora*) 1-5 - Difference in tree losses due to *Phytophthora* when grown on same rootstock.

21. Verticillium Wilt 1-5 - Ratings are based on observations of branch dieback on young trees.

22. Ceratocystis 1-5 - Disease is related to mechanical injury to the tree followed by kill of branches and scaffolds.

This form provides a system to evaluate commercial use of almond varieties for processor, producer and nurseryman in comparison to five standard varieties. Ratings are recorded from a numerical scale that gives a quantitative evaluation based in many cases on subjective judgement or experience. Strictly descriptive terms are placed in an introductory category.

NAME ______________________

ADDRESS ______________________

OCCUPATION: GROWER /_/

FIELDMAN /_/

RESEARCH /_/

EXTENSION /_/

HANDLER /_/

OTHER /_/ ______________ (specify)

ALMOND VARIETY EVALUATION SCHEDULE

INSTRUCTIONS: Use blank column(s) for test variety(ies). Write variety name or selection number on top of column. Give a numerical score for particular trait on scale of either 1-3, 1-5 or 1-10 as indicated. Use the ratings of the five standard varieties shown as guideposts. These ratings are intended as evaluations based on experience and judgement not as descriptions.

A. NUT CHARACTERISTICS

	Nonpareil	Merced 1/	Mission	Peerless	NePlus Ultra	Butte	Carmel	Fritz	Price Cluster	Ruby	Thompson		
Type of Shell	Paper	Soft	Semi-Hard	Hard	Soft								
Percent Kernel	65-70	55-60	45-50	35-40	55-60								
Usual Size Kernel (Count/Ounce)	20-25	20-25	25-30	20-25	18-23								
Kernel Shape (Width/Length) 2/	Long Oval .50-.55	Oval .55-.60	Short Oval .60-.65	Long Oval .55-.60	Long Narrow .42-.47								
Thickness - m.m. 2/	Flat to Med. 7.5-8.5	Medium 8.5-9.0	Plump 9.0-10.0	Medium 8.0-8.5	Medium 7.5-8.5								

1/ Merced is the principal variety in the California group.

2/ Usual Range

RATING SCHEDULE - MARKETING

I SHELLED NATURAL													
1. General Appearance 1-10	10	8	6	7	7								
2. Color (Lightness) 1-5	5	3	2	3	2								
3. Freedom from Doubles 1-10	10	8	4	6	4								
4. Freedom from Shrivels & Deformity 1-5	4	3	3	3	2								
5. Smoothness 1-5	5	4	3	3	3								

	Nonpareil	Merced	Mission	Peerless	NePlus Ultra	Butte	Carmel	Fritz	Price Cluster	Ruby	Thompson		
6. Resistance to Machine Damage 1-5	5	5	3	1	4								
7. Raw Flavor 1-5	4	3	4	1	2								
8. Ability to go into Major Market Classes 1-5													
a. Nonpareil	5	X	X	X	X								
b. California Group	X	5	X	4	3								
c. Mission	X	X	5	X	X								
9. Special Use 1-3													
a. Long Kernels	1	X	X	X	1								
b. Flat Kernels	1	X	X	X	X								
c. Extra Large	1	1	X	X	1								
d. Extra Small	X	X	1	X	X								
II <u>IN-SHELL</u>													
10. In-Shell 1-10	1	1	5	8	4								
III <u>BLANCHED</u>													
11. Ease of Blanching 1-10	10	8	1	7	7								
12. Splits 1-5	5	4	1	4	4								
13. Slivered 1-5	5	3	1	4	4								
14. Color (Whiteness) 1-5	3	3	1	3	3								
IV <u>MANUFACTURING STOCK</u>													
15. Slicing 1-5	5	5	2	4	4								
16. Flavor-Roasted 1-5	3	3	5	3	4								
17. Appearance-Roasted 1-5	5	3	4	3	2								
18. Salt/Flavor Adherence 1-5	2	3	5	3	3								
Total Marketing	90	73	56	67	64								

B. FIELD CHARACTERISTICS

	Nonpareil	Merced	Mission	Peerless	NePlus Ultra	Butte	Carmel	Fritz	Price Cluster	Ruby	Thompson		
Time of Bloom	Mid	Mid	Late	Early to Mid	Early								
Time of Harvest	Early	Late	Late	Early	Mid								
Tree Shape	Medium	Medium to Upright	Upright	Medium to Spreading	Spreading								
Tree Size	Large	Small to Medium	Large	Medium	Small to Medium								
BF Susceptibility	Yes	Yes	No	Yes	No								
Compatibility on Marianna 2624	No	Yes	Yes	Yes	Yes								
Production Per Acre (Five Year Average 1974-78)	1026	970	747	634	715								
Production Per Acre (1974-78) High / Low	1312-77 / 691-78	1213-76 / 467-78	918-77 / 434-78	682-77 / 571-78	915-77 / 460-78								

RATING SCHEDULE - FIELD

I TREE CHARACTERISTICS													
1. Potential Productivity 1-10	8	7	7	6	7								
2. Resistance to Bud Failure (BF) 1-5	3	2	5	4	5								
3. Pruning & Training 1-5	4	3	5	4	2								
4. Early Production (Precocity) 1-5	4	5	4	4	4								
5. Consistency of Bearing 1-5	4	3	4	4	3								
6. Resistance to Limb Breakage 1-5	2	4	5	4	3								
7. Blossom Resistance to Frost 1-5	5	3	3	2	3								
8. Freedom from Gummy Nuts & Corky-growth 1-5	5	2	3	5	3								
9. Resistance to Salt Injury 1-5	4	2	1	4	3								
10. Resistance to Herbicide Injury 1-5	5	3	2	4	5								

	Nonpareil	Merced	Mission	Peerless	NePlus Ultra	Butte	Carmel	Fritz	Price Cluster	Ruby	Thompson		
II <u>HARVEST CHARACTERISTICS</u>													
11. Uniformity & Rapidity of Ripening 1-5	4	2	3	4	3								
12. Ease of Knocking 1-5	4	1	3	5	4								
13. Ease of Hulling 1-5	3	2	4	1	3								
14. Shell Seal 1-5	2	2	5	5	3								
III <u>RESISTANCE</u>													
15. Worm Damage 1-10	4	2	10	10	6								
16. Mites 1-5	2	2	4	3	2								
17. Brown Rot 1-5	4	3	5	4	2								
18. Shot Hole 1-5	2	2	3	2	1								
19. Hull Rot 1-5	2	2	5	4	3								
20. Crown Rot (<u>Phytophthora</u>) 1-5	2	2	3	2	2								
21. Verticillium Wilt 1-5	3	4	4	3	3								
24. Ceratocystis 1-5	2	3	1	3	3								
Total Field	77	60	88	88	72								

Totals:

	Nonpareil	Merced	Mission	Peerless	NePlus Ultra	Butte	Carmel	Fritz	Price Cluster	Ruby	Thompson		
Marketing	90	73	56	67	64								
Field	77	60	88	88	72								
Overall	167	133	144	155	136								

Table 10

WEO, 1991 F10D SUMMARY Page 1 22-Jan-92

F10DSUM2.WK1

PARENTS	SLDG NO.	UTIL CODE	ROW	TRE	BLOOM (Days after Jan 1) 5%	50%	BEARING UNITS (Sum) Ts	Ss	CROP SET ON 4/1	8/28	HARVEST DATE	*NUT CHARACTERISTICS* SHELLING (%)	AVE. WT. (G)	NO./ OZ.	W/L	THICKNESS (CM)	DBL (%)	TWN (%)	WRM (%)	BLK (%)	BRK (%)	OTH (%)	SLD (%)
MILOW X F5 03-39	7924-14	1	1,2	1	51	54	6	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F5 04-06 X SOLANO	8021-89	1	1,2	2	52	55	7	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SB20 01-05 X SONORA	7906-31	1	1,2	3	48	52	4	0	2	1	AUG 28	79	1.21	23	0.68	0.93	0	10	0	0	0	6	50
SB20 01-19 X SONORA	7914-26	1	1,2	4	51	54	8	2	4	2	SEP 10	60	0.92	31	0.50	0.8	2	2	2	2	0	36	30
F5 04-06 X SOLANO	8021-77	1	1,2	5	51	55	4	4	2	3	SEP 13	65	0.86	33	0.51	0.8	0	0	0	0	0	2	12
SB20 01-05 X SONORA	7906-26	1	1,2	6	51	51	8	6	4	3	AUG 28	37	1.12	25	0.59	0.8	18	0	0	0	0	18	50
SB20 01-05 X SONORA	7906-01	1	1,2	7	51	53	6	4	2	3	SEP 10	26	1.43	20	0.60	0.8	0	6	0	2	18	4	50
SB07 02-01E X F5 03-52	7934-54	1	1,2	8	53	53	8	0	1	1	AUG 28	.	.	.	.	.	.	.	.	.	.	.	.
SB02 6A-11 (PARENT)	.	3	1,2	9	50	54	6	4	2	3	SEP 10	62	1.40	20	0.59	0.83	0	0	2	2	0	34	19
SONORA (PARENT)	.	3	1,2	10	48	52	8	4	3	2	AUG 28	71	1.33	21	0.49	0.89	0	10	0	2	0	22	30
MILOW X F5 03-39	7924-05	1	1,2	11	48	52	2	0	1	2	AUG 28	72	0.99	29	0.58	0.76	0	0	0	6	0	16	21
SB08 01-50W	6003-02	2	1,2	12	47	52	4	2	2	1	AUG 28	62	0.65	43	0.53	0.74	0	0	0	22	0	8	32
F5 04-10 X MILOW OR SOLANO	8023-10	1	1,2	13	52	52	9	4	3	2	AUG 28	55	0.93	30	0.60	0.79	0	0	0	0	0	12	22
SB08 02-04W	6006-12	2	1,2	14	51	54	7	5	4	2	AUG 28	66	1.09	26	0.58	0.88	0	0	2	2	0	4	27
SB08 01-45W	6002-38	2	1,2	15	52	55	4	6	2	2	AUG 28	55	1.18	24	0.67	0.93	12	0	0	12	0	82	43
F5 04-10 X SOLANO	8024-15	1	1,2	16	51	54	2	4	2	2	AUG 28	65	1.21	23	0.59	0.85	0	0	0	2	0	58	13
F5 04-10 X SOLANO	8024-18	1	1,2	17	51	54	7	5	5	2	AUG 28	77	0.74	38	0.52	0.8	0	2	0	6	0	8	24
NONPAREIL X F5 04-04	8007-19	1	1,2	18	52	55	12	7	4	2	AUG 28	41	0.88	32	0.58	0.83	0	2	0	2	0	46	50
TITAN X SB16,8-60 (PARENT)	7309-07	3	1,2	19	53	57	7	6	3	2	AUG 28	44	0.85	33	0.64	0.9	14	2	0	2	0	2	50
NONPAREIL (PARENT)	.	3	1,2	20	53	56	4	2	3	1	AUG 28	65	1.35	21	0.60	0.91	6	2	4	4	0	14	31
SB20 01-28 X SONORA	7920-22		1	21	47	52	2	4	3	2	SEP 10	72	1.15	25	0.47	0.82	4	12	4	4	0	54	23
NONPAREIL X F5 04-43	8011-11	1	1,2	22	52	55	6	6	4	1	AUG 28	45	0.93	30	0.58	0.8	0	0	0	0	0	0	50
NONPAREIL X F5 04-06	8008-02	1	1,2	23	52	55	2	2	2	2	AUG 28	59	0.85	33	0.56	0.72	0	0	8	0	0	6	26
PADRE X F5 04-10	8016-07	1	1,2	24	52	57	9	4	4	2	AUG 28	59	0.90	32	0.62	0.82	0	0	2	0	0	32	45
SB20 01-23 X SONORA	7918-16	1	1,2	25	53	55	10	4	3	2	AUG 28	45	1.23	23	0.51	0.82	0	0	0	2	0	58	45
NONPAREIL X F5 04-04	8007-24	1	1,2	26	52	55	6	4	4	2	AUG 28	30	0.95	30	0.62	0.71	12	0	2	2	4	18	50
SB20 01-05 X SONORA	7906-33	1	3,4	1	47	52	10	0	5	2	AUG 28	27	1.10	26	0.58	0.78	4	0	0	0	0	12	50
F5 04-06 X SOLANO	8021-38	1	3,4	2	53	56	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.

F10DSUM2.WK1

PARENTS	SLDG NO.	UTIL CODE	ROW	TRE	BLOOM (Days after Jan 1) 5%	50%	BEARING UNITS (Sum) Ts	Ss	CROP SET ON 4/1	8/28	HARVEST DATE	SHELL-ING (%)	AVE. WT. (G)	NO./ OZ.	W/L	THICK-NESS (CM)	DBL (%)	TWN (%)	WRM (%)	BLK (%)	BRK (%)	OTH (%)	SLD (%)
												******************NUT CHARACTERISTICS											*********************
SB20 01-28 X SONORA	7920-45	1	3,4	3	51	54	6	2	4	1	AUG 28	61	1.16	24	0.57	0.9	4	6	0	2	0	22	39
SB20 01-21 X SB20 01-29	7915-88	1	3,4	4	50	54	8	4	4	?	AUG 28	59	0.75	38	0.52	0.75	12	0	0	0	2	16	42
SB20 01-28 X SONORA	7920-24	1	3,4	5	52	55	2	4	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F5 04-10 X SOLANO	8024-12	1	3,4	6	50	54	8	2	5	2	AUG 28	62	0.77	37	0.54	0.71	0	0	0	0	0	10	12
MILOW X F5 03-60	7923-55	1	3,4	7	50	54	2	2	2	1	AUG 28	53	0.97	29	0.58	0.77	0	0	0	0	0	48	30
SB20 01-28 X SONORA	7920-20	1	3,4	8	53	58	2	4	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SB07 02-01E X F5 03-52	7934-55	1	3,4	9	53	57	6	2	2	2	AUG 28	48	0.77	37	0.58	0.85	16	2	0	2	0	10	43
PADRE X SB20 1-29	7927-56	1	3,4	10	52	56	3	4	3	2	OCT 8	46	1.21	23	0.59	0.96	50	0	0	0	0	6	50
F8S 53-60(SOURCE LOCATION)	.	1	3,4	11	51	54	8	2	3	2	SEP 10	62	1.19	24	0.46	0.82	0	2	0	2	0	2	26
SB07 02-01E X SB20 01-29	7932-87	1	3,4	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PADRE X SB20 1-29	7927-54	1	3,4	13	52	56	4	6	6	3	SEP 26	60	0.85	33	0.63	0.87	0	0	0	4	0	2	50
PADRE X F5 04-10	8016-05	1	3,4	14	53	57	8	4	5	2	AUG 28	64	0.91	31	0.55	0.88	0	0	0	0	0	8	37
NONPAREIL X F5 04-42	8011-04	1	3,4	15	53	56	8	2	3	3	OCT 8	26	1.07	27	0.58	0.85	2	0	0	0	0	6	50
NONPAREIL X F5 03-02	8006-10	1	3,4	16	52	54	4	4	3	3	SEP 10	31	1.09	26	0.62	0.98	0	2	0	2	0	4	50
PADRE X F5 04-10	8016-06	1	3,4	17	53	56	2	4	4	2	SEP 10	69	1.04	27	0.61	0.88	0	0	0	2	0	40	0
SB20 01-05 X SONORA	7906-13	1	3,4	18	50	54	8	4	5	2	SEP 13	52	1.20	24	0.56	0.9	2	4	0	2	0	8	41
SB20 01-05 X SONORA	7906-53	1	3,4	19	52	55	6	2	4	2	SEP 10	51	1.30	22	0.58	0.87	8	0	0	6	0	48	33
PADRE X SB20 1-29	7927-53	1	3,4	20	52	55	2	2	4	2	OCT 8	53	0.97	29	0.47	0.86	0	0	0	0	0	2	50
PADRE X F5 04-10	8016-17	1	3,4	21	52	52	8	2	6	3	SEP 26	59	1.18	24	0.64	1.04	0	0	0	0	0	26	6
F5 04-10 X SOLANO	8024-20	1	3,4	22	49	51	4	4	4	3	AUG 28	53	0.93	31	0.58	0.77	0	0	0	0	2	62	34
PADRE X F5 04-04	8013-06	1	3,4	23	51	54	8	4	3	3	AUG 28	43	0.94	30	0.62	0.89	0	0	0	0	0	76	50
TITAN X SB16,8-60 (PARENT)	7310-46	3	3,4	24	58	71	7	6	FLW	2	SEP 13	30	0.94	30	0.77	0.76	0	0	0	0	0	4	50
NONPAREIL X F5 04-11	8010-22	1	3,4	25	52	55	8	4	4	1	AUG 28	66	1.03	28	0.50	0.72	0	0	0	2	0	118	8
F5 04-06 X SOLANO	8021-95	1	3,4	26	52	55	6	0	3	2	SEP 13	34	1.27	22	0.53	0.85	0	0	0	0	2	0	43
USDA 75-3	.	5	5,6	1	57	101	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
J.H. HALE X BUTTE	7805-10	4	5,6	2	57	100	4	0	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PADRE (PARENT)	.	3	5,6	3	53	57	4	4	3	2	SEP 19	54	1.16	25	0.62	0.93	2	0	0	0	0	10	50
USDA CP 05-33 X OP	.	5	5,6	4	52	57	2	2	4	1	SEP 26	61	1.72	16	0.56	1.05	2	0	0	4	0	24	50

F10DSUM2.WK1

PARENTS	SLDG NO.	UTIL CODE	ROW	TRE	BLOOM (Days after Jan 1) 5%	50%	BEARING UNITS (Sum) Ts	Ss	CROP SET ON 4/1	8/28	HARVEST DATE	SHELL-ING (%)	AVE. WT. (G)	NO./ OZ.	W/L	THICK-NESS (CM)	DBL (%)	TWN (%)	WRM (%)	BLK (%)	BRK (%)	OTH (%)	SLD (%)
USDA 20.5-13	.	5	5,6	5	52	57	2	0	2	0	.	.	.	.	.	.	.	.	.	.	.	.	.
SB16 12-64 X OP	7347-16	3	5,6	6	53	56	4	2	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.
SB16 12-64 X OP	7347-05	3	5,6	7	59	72	6	4	FLW	1	SEP 19	48	1.01	28	0.59	0.71	2	0	0	0	0	8	50
MISSION (PARENT)	.	3	5,6	8	53	60	2	4	?	3	OCT 8	44	1.33	21	0.64	1.03	12	0	0	0	0	2	50
SB16 12-64 X OP	7347-15	3	5,6	9	53	60	2	0	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.
J.H. HALE X BUTTE	7805-14	4	5,6	10	56	100	8	6	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.
USDA 19.5-12	.	5	5,6	11	56	101	4	0	?	0	.	.	.	.	.	.	.	.	.	.	.	.	.
SB16 09-62 X OP	7340-05	3	5,6	12	53	57	4	4	2	2	AUG 28	40	0.92	31	0.57	0.85	0	0	0	0	0	44	50
SB08 03-100W	6021-18	2	5,6	13	52	56	8	4	2	1	SEP 10	61	0.95	30	0.56	0.82	18	8	0	0	0	4	45
USDA 92-59	.	5	5,6	14	53	55	2	3	2	1	SEP 10	73	1.43	20	0.59	0.84	0	0	0	0	0	42	50
USDA 25-26 X SELF	.	5	5,6	15	44	57	4	4	5	3	SEP 26	19	1.57	18	0.70	0.78	6	0	0	0	0	28	50
J.H. HALE X CARMEL	7804-10	4	5,6	16	53	57	6	2	?	4	SEP 10	16	1.29	22	0.53	0.82	0	0	0	0	0	40	50
J.H. HALE X BUTTE	7805-05	4	5,6	17	.	.	10	6	?	4	SEP 10	16	1.15	25	0.58	0.76	4	0	0	0	0	4	50
SB16 02-44 X SB6 56-88 (PARENT)	7326-01	3	5,6	18	52	55	8	4	4	3	AUG 28	31	0.67	42	0.63	0.74	0	0	0	6	0	0	50
SB16 02-44 X SB6 56-88 (PARENT)	7326-08	3	5,6	19	53	56	10	2	6	4	AUG 28	30	0.67	43	0.62	0.69	0	0	0	0	0	2	50
PADRE X P54P455	7926-06	4	5,6	20	53	56	10	4	7	4	SEP 10	18	0.85	34	0.61	0.67	0	0	0	4	0	10	50
PADRE X P54P455	7926-02	4	5,6	21	53	57	6	2	?	4	SEP 10	17	1.02	28	0.49	0.63	0	0	0	0	0	50	50
F5 04-06 X SOLANO	8021-35	1	5,6	22	52	55	4	0	1	2	SEP 10	75	1.09	26	0.51	0.87	0	0	0	8	0	4	43
SB20 01-21 X SONORA	7916-09	1	5,6	23	52	56	4	2	3	3	SEP 10	51	1.16	24	0.40	0.81	8	2	2	6	0	2	36
SB20 01-05 X SONORA	7906-22	1	5,6	24	52	55	1	6	4	3	SEP 19	65	1.52	19	0.54	0.99	10	6	0	0	0	10	43
PADRE X F5 04-04	8013-12	1	5,6	25	53	56	6	4	2	2	SEP 19	27	1.07	26	0.68	0.76	0	0	0	0	0	22	50
NONPAREIL X F5 04-04	8007-15	1	5,6	26	52	56	2	4	3	3	AUG 28	26	0.97	29	0.68	0.88	0	8	0	2	8	8	50
PLANT PATH 01-15	.	6	7,8	1	50	55	2	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
USDA 18-130	.	5	7,8	2	52	56	2	0	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.
USDA 10A-14 X SELF	.	5	7,8	3	52	55	2	2	1	1	SEP 10	57	1.22	23	0.68	0.69	24	0	0	0	0	24	31
SB16 09-59 X SB16 09-60	7339-02	3	7,8	4	53	56	10	4	2	2	AUG 28	29	0.69	41	0.61	0.72	2	0	0	0	0	10	50
THOMPSON (PARENT)	.	3	7,8	5	53	57	4	2	2	3	SEP 10	63	1.34	21	0.62	0.86	6	0	0	4	0	20	39
J.H. HALE X CARMEL	7804-02	4	7,8	6	56	101	10	4	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.

F10DSUM2.WK1

PARENTS	SLDG NO.	UTIL CODE	ROW	TRE	BLOOM (Days after Jan 1) 5%	BLOOM (Days after Jan 1) 50%	BEARING UNITS (Sum) Ts	BEARING UNITS (Sum) Ss	CROP SET ON 4/1	CROP SET ON 8/28	HARVEST DATE	******************NUT CHARACTERISTICS SHELL-ING (%)	AVE. WT. (G)	NO./ OZ.	W/L	THICK-NESS (CM)	DBL (%)	TWN (%)	WRM (%)	BLK (%)	BRK (%)	OTH (%)	SLD (%) *********************
USDA 20.5-18	.	5	7,8	7	59	76	2	4	FLW	1	SEP 13	61	1.16	25	0.57	0.81	0	0	0	0	0	8	12
SB08 04-03E	6021-39	2	7,8	8	53	55	4	0	2	1	SEP 10	66	0.86	33	0.57	0.88	0	0	0	0	0	12	38
USDA 14-87	.	5	7,8	9	53	57	4	4	?	1	.	.	.	.	.	.	.	.	.	.	.	.	.
SB16 02-44 X SB6 56-88 (PARENT)	7326-04	3	7,8	10	52	57	10	4	3	5	AUG 28	29	0.89	32	0.65	0.72	0	2	0	0	0	18	50
USDA 18.5-B	.	5	7,8	11	56	76	4	0	?	2	SEP 26	50	1.38	20	0.60	0.99	14	0	0	8	0	18	50
USDA 19.5-09	.	5	7,8	12	.	.	2	0	?	0	.	.	.	.	.	.	.	.	.	.	.	.	.
J.H. HALE X CARMEL	7804-04	4	7,8	13	53	57	8	4	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40A-17	.	3	7,8	14	10	33	8	4	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.
USDA 19.5-08	.	5	7,8	15	52	55	4	0	3	1	AUG 28	65	1.31	22	0.62	0.81	0	0	0	14	0	22	50
USDA 20.5-13	.	5	7,8	16	59	71	4	0	?	2	SEP 10	62	1.32	21	0.54	0.84	0	2	0	2	0	46	24
SB16 02-44 X SB6 56-88 (PARENT)	7326-03	3	7,8	17	52	55	6	4	2	1	AUG 28	33	0.56	50	0.61	0.71	0	0	0	4	0	2	50
SB16 09-09 (TEXAS X HYBRID A)	6855-01	3	7,8	18	47	52	4	4	3	2	SEP 10	27	1.01	28	0.67	0.85	2	0	0	0	0	12	50
PADRE X P54P455	7926-03	1	7,8	19	28	42	4	0	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PADRE X P54P455	7926-05	1	7,8	20	53	56	8	6	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SB16 02-44 X SB6 56-88 (PARENT)	7326-02	3	7,8	21	53	56	10	4	4	3	AUG 28	30	0.66	43	0.67	0.79	0	2	0	2	0	2	50
PADRE X P54P455	7926-01	1	7,8	22	53	55	10	3	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PADRE X P54P455	7926-04	1	7,8	23	53	58	10	4	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SB20 01-28 X SONORA	7920-61	1	7,8	24	52	56	8	4	3	3	SEP 26	59	1.31	22	0.61	1.1	0	10	0	4	0	14	19
NONPAREIL X F5 04-42	8011-20	1	7,8	25	53	56	6	4	3	5	AUG 28	27	0.96	29	0.56	0.79	14	0	0	0	0	62	50
PADRE X F5 03-02	8012-33	1	7,8	26	51	54	4	2	5	3	AUG 28	59	0.98	29	0.58	0.83	0	0	2	0	0	72	18
PL PATH,1- 5	.	6	9	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PL PATH,1- 5	.	6	9	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PL PATH,2-15	.	6	9	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PL PATH,2-15	.	6	9	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PL PATH,2-28	.	6	9	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PL PATH,2-28	.	6	9	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PR HORTULANA	.	6	9	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PR HORTULANA	.	6	9	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

F10DSUM2.WK1

PARENTS	SLDG NO.	UTIL CODE	ROW	TRE	BLOOM (Days after Jan 1) 5%	50%	BEARING UNITS (Sum) Ts	Ss	CROP SET ON 4/1	8/28	HARVEST DATE	NUT CHARACTERISTICS SHELL-ING (%)	AVE. WT. (G)	NO./ OZ.	W/L	THICK-NESS (CM)	DBL (%)	TWN (%)	WRM (%)	BLK (%)	BRK (%)	OTH (%)	SLD (%)
SB16,14-16 PA 6828-1C	6828-1C	6	9	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SB16,14-16 PA 6828-1C	6828-1C	6	9	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PL PATH,2-15	.	6	9	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PL PATH,2-15	.	6	9	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SB16,14-13 PA 6827-2A	6827-2A	6	9	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SB16,14-13 PA 6827-2A	6827-2A	6	9	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PR HORTULANA	.	6	9	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PR HORTULANA	.	6	9	16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
TRUSITO (SBD 12-04)	.	3	9	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
TRUSITO (SBD 12-04)	.	3	9	18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PEERLESS (F7 05-04)	.	3	9	19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PEERLESS (F7 05-04)	.	3	9	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-06 X OP (F10C 09-22)	.	7	9	21	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-06 X OP (F10C 09-22)	.	7	9	22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-36 X OP (F10C 15-01)	.	7	9	23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-36 X OP (F10C 15-01)	.	7	9	24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-22 X OP (F10C 12-28)	.	7	9	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-22 X OP (F10C 12-28)	.	7	9	26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 71-31 X OP (F10C 25-10)	.	7	10	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 71-31 X OP (F10C 25-10)	.	7	10	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LEGRAND X OP	.		10	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
LEGRAND X OP	.		10	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(DR KESTER; ALMOND#4)	.	4	10	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(DR KESTER; ALMOND#4)	.	4	10	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(DR KESTER; ALMOND#1)	.	4	10	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(DR KESTER; ALMOND#1)	.	4	10	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(SB06 53-25-02; ALMOND#2)	.	4	10	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(SB06 53-25-02; ALMOND#2)	.	4	10	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

F10DSUM2.WK1

PARENTS	SLDG NO.	UTIL CODE	ROW	TRE	BLOOM (Days after Jan 1) 5%	50%	BEARING UNITS (Sum) Ts	Ss	CROP SET ON 4/1	8/28	HARVEST DATE	******NUT CHARACTERISTICS****** SHELL-ING (%)	AVE. WT. (G)	NO./ OZ.	W/L	THICK-NESS (CM)	DBL (%)	TWN (%)	WRM (%)	BLK (%)	BRK (%)	OTH (%)	SLD (%)
(DR KESTER; ALMOND#5)	.	4	10	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(DR KESTER; ALMOND#5)	.	4	10	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(DR KESTER; ALMOND#6)	.	4	10	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(DR KESTER; ALMOND#6)	.	4	10	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 76-45 X OP (F10C 20-51)	.	7	10	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 76-45 X OP (F10C 20-51)	.	7	10	16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 71-65 X OP (F10C 32-22)	.	7	10	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 71-65 X OP (F10C 32-22)	.	7	10	18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-36 X OP (F10C 15-02)	.	7	10	19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-36 X OP (F10C 15-02)	.	7	10	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-35 X OP (F10C 29-45)	.	7	10	21	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-35 X OP (F10C 29-45)	.	7	10	22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 73-41 X OP (F10C 30-79)	.	7	10	23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 73-41 X OP (F10C 30-79)	.	7	10	24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-35 X OP (F10C 29-41)	.	7	10	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F8 72-35 X OP (F10C 29-41)	.	7	10	26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

YIELD PARAMETERS IN ALMOND PRODUCTION

PRODUCTION IN ALMOND = Pounds/acre
= pounds/tree x number of trees/acre (density)

Pounds/tree = number of nuts x average kernel weight

During life of an orchard,
YIELD POTENTIAL depends upon:

1. Precocity = how fast does an orchard come into bearing
2. average yield/acre
3. consistency of yield (alternate bearing)

MODEL FOR ANALYZING YIELD POTENTIAL

based upon 2 year developmental cycle from initial shoot emergence to final nut production
(see Figure ooo)

a. Two year seasonal cycle is divided into 9 key steps at which final yield can be affected.
b. These 9 steps fall into three groups
c. Two overlapping cycles are in progress at the same time, one starting one year after the other

Blossom density potential (also see Model II)
1. Vegetative growth (terminal and lateral shoots)
2. Flower bud initiation
3. Flower bud development

Reproductive potential
4. pollination
5. Fertilization (pollen compatibility)
6. abscission of nuts (retention)
7. Development of rejects

Weight potential
8. Establishment of nut size
9. Accumulation of dry weight

1. Vegetative growth

a. occurs in March, April, May but depends upon the kind of growth habit and bearing units involved (See Model II. Bud development)

b. any condition that expands vegetative growth (e.g. increased water, high nitrogen availability, prior heavy pruning) tends to increase the future yield potential.

c. on the other hand, conditions that inhibit growth (e.g., water or nutrient stress) tends to decrease the future yield potential and is a factor in alternate bearing.

d. high nut density (i.e., percent set) tends to decrease growth and the total bud population for the next year and is a factor in alternate bearing.

2. Flower bud initiation

a. arrangement: depends upon growth habit; develops in lateral buds on spurs and sometimes on shoots (see Growth Habit). never terminal.

b. timing: occurs after terminal growth ceases and lateral buds develop scales and are quiescent. Inductive shift from vegetative to flowering is complete by mid August. Prior to that induction can be inhibited.

c. inhibition: severe moisture stress and(or) heat may inhibit flower bud induction and is a factor in alternate bearing.

d. vigor: excess vigor may tend to depress flower bud induction.

3. Flower bud development

a. timing: begins in late August and September and continues through the fall and winter

b. Exposure to a certain amount of chilling is required for proper development of flower buds and for emergence of shoot buds in the following spring. Occurs usually during late October, November and first part of December.

c. Failure to achieve proper development may result in bud drop during winter (associated with high temperature and/or moisture stress) and poorly developed flowers (undeveloped pistils) that drop during or immediately after bloom.

4. Flowering and Cross-pollination

a. cross-pollination is the transfer of pollen from flowers of one variety to another by bees.

b. studies show that maximum set (see next section) is proportional to the number of flowers pollinated.

c. Pollination is affected by weather (temperature, wind, rain), numbers of pollinators (bees) and their flight distribution and arrangement of pollinizers (variety combination). A Pollination Model has been developed (Hoffman-DiGrandi, Thorp and Loper 1991).

d. This period is the single most critical point in the yield cycle in determining yield in any one year.

5. Flowering and Fertilization

a. Fertilization is the joining of pollen and egg gametes within the ovule following pollen tube growth down the style. Requires that the pollen be cross-compatible with the stigma and style of the flower.

b. Relative probability to achieve fertilization appears to vary from flower to flower and is conditioned by internal factors probably established during development which are present at the time of bloom.

c. Timing of pollination may be a factor in that embryo sac may deteriorate before pollen tube growth is completed.

d. SET refers to the proportion of flowers that produce fruits (nuts) and is usually given in PERCENT. Its value is the product of the probabilities of the two independent factors: <u>pollination percentage</u> and <u>fertilization percentage</u>. Any reduction in the population of viable flowers (e.g. disease, frost, poor development, etc) or of the population of pollinizers has a net reduction in final set. Occurs because the reduction of one factor cannot be offset by the reduction of another.

6. Abscission and\or nut retention

a. After flowering, natural "thinning" tends to occur to eliminate poorly developed flowers (first drop at or shortly after bloom), unfertilized flowers (second drop about 3 weeks after bloom) and surplus (?) fruit (third drop 4 to 8 weeks after bloom)

b. Third drop ("June drop") may result from various physiological conditions, including excess shading, certain mineral deficiencies and others not understood.

7. Reject kernels

a. At harvest and/or during processing, some individual kernels must be rejected because of infestation or poor quality.

b. Main classes include the following:

"blanks" - no embryo within the pellicle: uncertain causes but may be failure to be fertilized; frost injury in embryo

"Shrivels" - undeveloped or unfilled kernels

"Gummy" - "bleeding" of gum inside fruit. Often associated with injury (see next) in fruit. Some varieties more susceptible.

"Corky or scabby growth" - callus growth on kernels that come from cracks in the shell early in the development period

"Worm damage" - Navelorange worm or twig borer that infest the softer shelled kernels beginning when the hulls begin to "split" on the tree.

8. Establishment of nut size

a. Size dimensions of individual kernels is established during the early part of the fruit growth cycle (March, April).

b. Affected by variety (genetically controlled), crop density (size and number are reciprocally related), growing conditions (vigor tends to increase size).

9.Accumulation of dry weight

a. Pattern of weight accumulation takes place in latter half of the nut development process and continues until nuts split at maturity

b. Inhibited by moisture stress, defoliation and any condtions that adversely affect the production and transfer of photosynthates.

c. Adverse conditions may be expressed by shriveled and unfilled kernels.

Appendix B

A CLASSIFICATION OF GROWTH HABITS TRAITS IN ALMOND

Growth habit is the arrangement of vegetative growth and location of flowers and nuts. Growth habits characterize different varieties and is a parameter of yield potential. Growth habit traits are largely controlled by breeding through the selection of tree structure and growth and development patterns. However, the expression of growth habit can be greatly influenced by environmental conditions and management procedures primarily through the control of vigor.

Growth habit is composed of different kinds of BEARING UNITS. A bearing unit is a vegetative structure (shoot or spur) that originates from a single bud bearing a combination of vegetative and flower buds. Shoot growth may begin from either terminal or lateral buds. An outline of the basic types of bearing units of this type is as follows:

I. TERMINAL GROWTH. Shoot growth emerging from terminal buds. Elongation continues from the apical shoot often in flushes of growth. Lateral growing points produced in axils of leaves may produce vegetative buds, flower buds or lateral shoots during the same year of initiation. One or more buds are produced at each node.

a. TS - Terminal Shoot - few or no flowers
Lateral buds are essentially all vegetative. Varieties in this category are primarily spur producers. Characteristic of Mission (Texas), Padre, Ferragnes, Ferraduel, Truoito.

b. TSf - Terminal Shoot - flowers
Various numbers of flower buds develop at single nodes of the shoot singly or in combination with vegetative buds. Varieties with this habit include 'Sonora', 'Ne Plus Ultra', 'Solano' and 'Vesta'. Varieties with this kind of growth habit tend to come into bearing early and respond to conditions that increase vigor. Some of these varieties show alternating bearing under stress conditions.

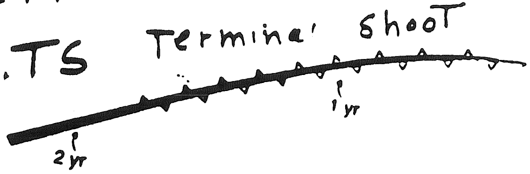
c. Csl - Current Season Laterals.
Lateral buds on current seasons shoots grow into lateral shoots during the same year as initiated. Occurs in Nonpareil, Ne Plus Ultra and many other varieties. It is common in one or two year old trees.

d. ASp - Annual spur.
Short lateral spurs developing on one year old (current season) shoots. Lateral buds are flower buds with terminal vegetative. Occurs in such varieties as 'Butte', 'Carrion', 'Fritz', 'Carmel', and 'Merced'. This type accounts in part for potential for precocity and high yields. Full potential requires high vigor conditions to stimulate vegetative growth.

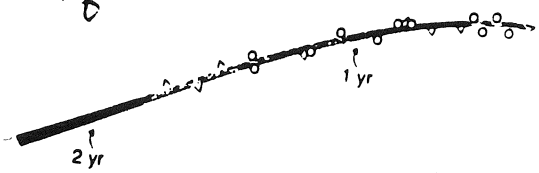
Types of Bearing Units

I. Terminal Growth

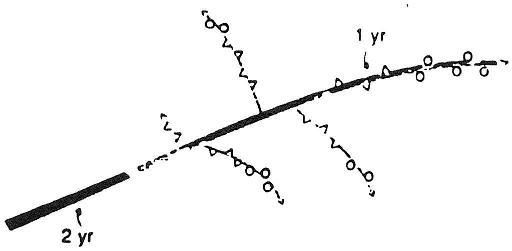
a. TS Terminal Shoot



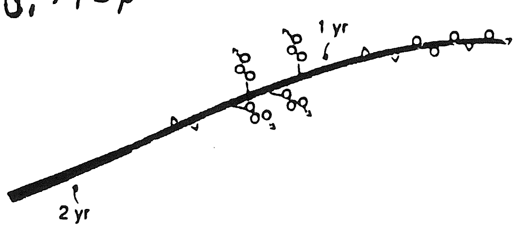
b. TSf Terminal Shoot - flowers



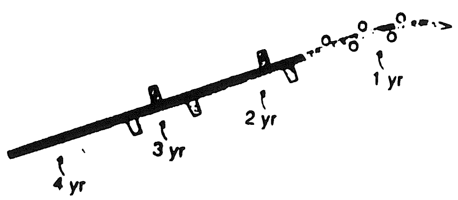
c. Csl - Current Season lateral



d. ASp - Annual spur

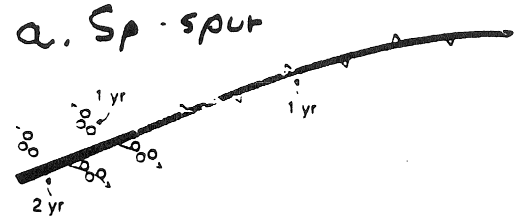


e. TSp Terminal Spur

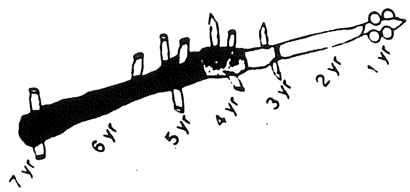


II Lateral growth

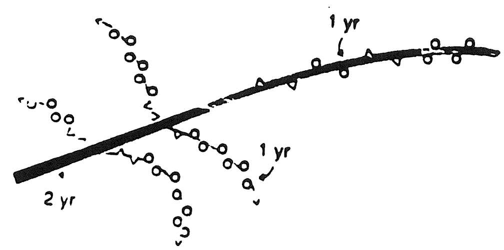
a. Sp - spur



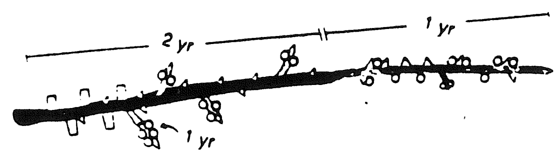
b. PSp Perennial spur

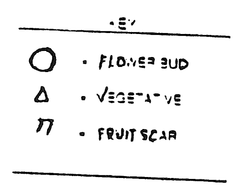


c. LS - Lateral Shoot



III. Mixed





Types of Bearing Units

e. TSp - Terminal spur.

Short spurlike shoots produced from the tip of shoots. Flower buds predominate in lateral positions which may or may not produce nuts. Over several years produces a long continuous bare shoot either with either blank nodes or old stem scars. Characteristic of Ripon, Planada and to some extent Tardy Nonpareil. It is not associated with consistently high production.

II. LATERAL GROWTH. Lateral buds on long terminal shoots give rise to lateral vegetative shoots. These growths then differentiate lateral flower buds during this second year of development which then flower and fruit during the third year following the emergence of a Type 1 (TS) shoot.

a. Sp - Spur.

A <u>spur</u> is a short thickened growth usually less than 5 inches long bearing 1 to 10 lateral flower buds and a vegetative terminal bud. Grows from a lateral bud on a terminal shoot. Single flower buds develop at each node. If the spur is weak or if there is high fruit set on the spur, the apical bud may not survive and the spur lives only one year.

b. PSp - Perennial spur.

This structure results when a spur continues to repeat its growth habit in consecutive years from the apical vegetative bud. This pattern may continue for a number of years if the tree is healthy and sufficient vigor is maintained.

c. LS - <u>Lateral shoots</u>, or hangers

This structure results when a lateral vegetative during the second year emerges and continues to grow into a long shoot bearing essentially all single flower buds. Length is arbitrarily < 5 inches but may grow 12 or more inches. This habit is common with certain almond species, (e.g., <u>Prunus fenzliana, P. argentea</u>, etc.) but also occurs with some varieties as Nonpareil when subjected to conditions producing high vigor. This pattern is typically found in many peach varieties after bearing pattern is well established.

III. MX - MIXED. Combination of both terminal and lateral bearing units. Most commercial varieties of almonds have combinations of growth habit. This type of growth habit is advantageous because the terminal shoot bearing habit results in early flower initiation in a young tree, the reversion to the spur habit expands the bearing surface exponentially, and the induction of new growth allows for the continuous renewal of bearing surface as the tree becomes older.