Nitrogen Fertilization For Bartlett Pears

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A leaf nitrogen content of 2.3% or higher in June should be considered their goal by pear growers, according to this study in Lake and Sacramento counties. Leaf analysis offers a good basis for determining whether sufficient nitrogen exists for adequate fruit set. Once this level has been obtained, an individual orchard evaluation is necessary to determine the minimum rate needed to maintain it. However, if higher levels are encountered, there need be little concern about adverse effects on fruit quality, but only that more money may have been spent for fertilizer than necessary.

THE QUESTION of the proper rate of nitrogen for Bartlett pear trees has concerned growers and researchers for several years. Grower practices are quite variable, and experimenters have tested applications of from 1 to 10 lbs of actual nitrogen per tree with inconclusive results. Recent experiments in Lake and Sacramento County pear orchards and in the University's greenhouses at Davis have afforded some insight into the problem and the resulting data offer information on: (1) the effect of nitrogen on pear fruit quality and maturity; (2) the effect of nitrogen on fruit set; and (3) the uptake of nitrogen by pear trees.

Experimental plots were set up in two 40-year-old orchards (one in Lake and one in Sacramento County) in 1965 and continued in 1966. The source of nitrogen was ammonium nitrate. The rates of actual nitrogen were 0, 1.5, 1.5+1.5 (split), 3.0, 6.0 and 12.0 lbs per tree per year, applied in late February. The split application was applied in late February and late May. There were 12 trees in each treatment at each location, or a total of 144 test trees.

The range in leaf nitrogen levels, as shown in table 1, was very small considering the wide range of nitrogen applied, indicating a lack of any great response to nitrogen fertilization. There also appeared to be no carryover from the 1965 to the 1966 season.

The fruit was harvested the day before commercial harvest began. The results from both years were so similar that only the 1966 data are presented (table 2). Because of the variability in leaf nitrogen levels among the trees of the different treatments, the maturity and quality data were grouped and averaged according to the range in nitrogen levels obtained (table 2) regardless of treatment. No differences were found in soluble solids, pH, and firmness, or in the rate of ripening as determined by respiration and ethylene measurements.

Fruits were also obtained from another orchard in Sacramento County from trees of known nitrogen deficiency (1.4% N) and compared with fruits from trees with sufficient nitrogen (2.3% N) grown in the same orchard. Again, there were no differences in soluble solids, pH, firmness, or ripening time.

Fruits from all three orchards were stored at 32°F for various periods of time (1 to 3½ months), removed, and ripened. No differences were detected in the apperance of the fruit or in ripening time that could be related to the different nitrogen treatments. Random tastings indicated no apparent differences in flavor. The data indicate that the pear fruit is insensitive to differential nitrogen fertilization, at least over the range presented.

Probably the most critical influence of nitrogen nutrition is its effect on fruit set. Table 3 presents data relating leaf nitrogen content to fruit set. A level of 2.3% or higher in June appears necessary to insure adequate fruit set the following year.

Due to the narrow range of leaf nitrogen found in the field, with application rates between 0 and 12 lbs of nitrogen, an experiment was initiated to study the uptake of nitrogen by Bartlett pear trees under the more controlled conditions of the greenhouse. The trees were grown in sand culture and a series of solutions applied, ranging in nitrate concentration from 0 to 135 milliequivalents per liter. These data, along with those of nitrogen uptake by peaches (as a comparison) are

TABLE 1. EFFECT OF NITROGEN TREATMENTS ON TOTAL LEAF NITROGEN

Treatment	LAKE COUNTY				
	5/65	8/65	10/65	5/66	8/66
lbs N	% Dry weight				
0	2.46	2.49	2.24	2.79	2.46
1.5	2.73	2.55	2.31	2.91	2.38
3.0	2.61	2.49	2.34	2.82	2.42
1.5 + 1.5	2.53	2.40	2.31	2.81	2.44
6.0	2.69	2.55	2.33	2.92	2.48
12.0	2.67	2.50	2.44	2.90	2.39
	SACRAMENTO COUNTY				
	5/65	7/65	10/65	5/66	7/66
	% Dry weight				
0	2.38	2.06	1.75	2.50	2.29
1.5	2.74	2.21	2.05	2.65	2.51
3.0	2.69	2.33	2.07	2.70	2.55
1.5 + 1.5	2.59	2.23	2.04	2.69	2.58
6.0	2.76	2.41	2.10	2.80	2.63
12.0	2.60	2.45	2.19	2.68	2.60

TABLE 2. THE EFFECT OF NITROGEN ON SOLUBLE SOLIDS, pH, FIRMNESS, AND RIPENING RATE IN BARTLETT PEAR FRUITS.

Leaf nitrogen range at harvest	Soluble solids	pH	Firmness	Days to ripen @ 68°F
%	%		lbs	
	SACRAMENTO COUNTY TEST			
2.0–2.2	10.0	4.04	19.4	6
2.2–2.4	10.0	4.06	19.7	6
2.4–2.6	10.1	4.07	19.7	6
2.6–2.8	10.0	4.07	19.7	6
	LAKE COUNTY TEST			
2.0–2.2	11.1	4.16	18.2	6
2.2–2.4	11.2	4.15	18.5	6
2.4–2.6	11.2	4.11	18.7	6
2.6–2.8	11.1	4.17	18.4	6

TABLE 3. LEAF NITROGEN VERSUS PERCENTAGE OF FRUIT SET IN BARTLETT PEARS.

Leaf N 1965		Number of fruits (1966) per 100 blossom spurs
6/7	9/8	
%	%	
1.80	1.40	2.8
1.90	1.58	7.0
2.02	1.72	11.4
2.32	2.02	14.2
2.34	2.04	17.2

TABLE 4. LEAF NITROGEN CONTENT OF PEARS AND PEACHES GROWN IN SAND CULTURE UNDER DIFFERENTIAL NITROGEN TREATMENTS (SAMPLED AFTER SIX WEEKS)

Nitrogen content of nutrient solution	Pear leaf nitrogen	Peach leaf nitrogen
meq/liter	%	%
0	2.45	3.50
5	2.33	3.76
15	2.53	4.43
45	2.46	5.67
90	2.74	.....
135	2.86	7.12

presented in table 4. Between the lowest and highest nitrogen treatments, pear leaves had a range in nitrogen content of 2.3 to 2.8% while peach leaves had a range of 3.5 to 7.1%. These data indicate that pear roots exhibit a highly buffered reaction to nitrogen uptake.

From the grower's standpoint, the amount of nitrogen applied is apparently not critical and there is no need to worry that heavy applications might bring about abnormally high and unfavorable nitrogen levels within the trees. In fact, growers should not expect much response if the leaf nitrogen level is already sufficient (2.3% or higher in June).

Although nitrogen level has little or no effect on fruit maturity or quality, as shown by this study—or on fruit size (according to data from other states)—it does have a great deal to do with yield, because of its effect on fruit set. An adequate leaf nitrogen level should be maintained to insure sufficient fruit set. However, the nitrogen uptake data from current tests indicate that it may be difficult to determine when sufficient nitrogen has been applied, since the leaf nitrogen content is not necessarily related to the amount of nitrogen applied. The particular orchard used in the test in Lake County, and one of the orchards in Sacramento County, were maintained at an adequate nitrogen level with 1½ lbs of nitrogen applied per tree each year. The other orchard in Sacramento County, under grass sod and growing on shallow soil, required 3 to 5 lbs of nitrogen per tree per year for several years to attain an adequate level.

It appears that for most orchards that are mature, vigorous and high-producing (clean-cultivated and not under sod), 1½ lbs of nitrogen per tree annually will maintain adequate nitrogen levels in the trees. Orchards with grass sod may require an additional ½ to 1 lb of nitrogen per tree annually. Problem orchards with shallow or poorly drained soils, or those with poorer soil types and a history of weak chlorotic trees, may need more nitrogen to attain a nitrogen level sufficient for good fruit set. After a satisfactory level is attained, a grower may need to experiment to determine what rate of application is needed to maintain it.

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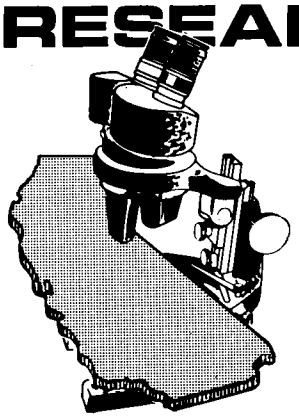
RESEARCH PREVIEWS



A continuing program of research in many aspects of agriculture is carried on at University campuses, field stations, leased areas, and many temporary plots loaned by cooperating landowners throughout the state. Listed below are some of the projects currently under way, but on which no formal progress reports can yet be made.

CALIFORNIA TEA

University agronomists are experimenting with tea plants to determine adaptability to California conditions. Over 15,000 plants have been set out in both foothill and valley plots. Some are showing promise for commercial production.

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QUEEN BEE COLONIES

Queen bees have long been considered incompatible with one another under any circumstances. Davis entomologists have developed a method of obtaining tolerance in many queens and have established queen "colonies" under laboratory conditions which present many new and valuable research possibilities.

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STARLING CONTROL

Agricultural engineers and animal physiologists have had moderate success in "herding" flocks of starlings away from feedlots by using amplified sound. Loud speakers connected to a recorder on which a distress call had been taped were effective within the limits of the sound but changing wind patterns present problems.

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RANGELAND DRILL

An experimental rangeland drill, modified to permit spraying for weed control, fertilizing, and seeding in one operation, has been developed by agronomists for setting out test plots in typical rangeland. The drill will operate on any terrain that can be readily traversed by a crawler-type tractor and has been used at both the Hopland and Sierra Foothill field stations.

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FLAX IMPROVEMENT

Plant breeders at Riverside are making a number of interspecific crosses in attempts to transfer desirable germ plasm from wild to cultivated flax species. In other experiments 50 species are being subjected to greenhouse culture for wilt resistance tests.

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BIRD WATCHERS

Part of the University's efforts at developing biological control methods for forest insects consists of studying the foraging habits of birds that feed on the insects. In some instances nesting boxes are provided for the birds but chipmunks have found the boxes convenient too so adjustments must be made.

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CARPET SERVICEABILITY

Staff members of the Consumer Sciences Department, at Davis, are attempting to test the serviceability of carpets having different fibers, fiber contents, and pile construction. Machinery is being developed to subject the carpets to many normal conditions of use—foot traffic, pressure from furniture, soiling, and even air pollution.

CALIFORNIA AGRICULTURE

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