ROBERT THILLIPS PROJ. No. 77. PH

**Project Title: Environmental Variables and Crop Protection** 

## ANNUAL REPORT 1977

- 1. <u>Objectives</u> The objective of the research is to correlate environmental variables with crop production and develop a method of preparing an early, accurate forecast.
- 2. <u>Interpretive Summary</u> Results have been very good. The early forecasts are more accurate than the early forecasts made by the State; the final 1977 forecast is within one percent of the crop.
- 3. Experimental Procedure Environmental conditions are monitored throughout the year. Precipitation and temperature are most important, although humidity can be important at bloom. Solar radiation is important in spring. Total cooling must be watched and of course low temperatures can be disastrous after bloom. The 1978 season will be interesting as there was more tree stress in 1977 than in any recent year. Late spring-early summer temperatures are critical and are a major object of study.

Results

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ALMOND FORECASTS

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	California Crop an	nd Livestock: Reporting Service
221,350,000 213,850,000 216,500,000	May 10, 1974 June 10 July 10	205,000,000 205,000,000 220,000,000
<u> 1974 Final</u>	Crop: 230,000,000	pounds
170,000,000 173,000,000	May 10, 1975 June 10 July 10	170,000,000 170,000,000 165,000,000
1975 Final	Crop: 185,000,000	pounds
257,500,000 257,500,000	May 10, 1976 July 10	255,000,000 280,000,000
<u> 1976 Final</u>	Crop: 287,000,000	pounds
305,000,000 315,000,000	May 10, 1977 July 10	295,000,000 310,000,000
	213,850,000 216,500,000 <u>1974 Final</u> 170,000,000 173,000,000 <u>1975 Final</u> 257,500,000 257,500,000 <u>1976 Final</u> 305,000,000	221,350,000 May 10, 1974   213,850,000 June 10   216,500,000 July 10   1974 Final Crop: 230,000,000   170,000,000 May 10, 1975   173,000,000 May 10, 1975   173,000,000 June 10   July 10 July 10   1975 Final Crop: 185,000,000   257,500,000 May 10, 1976   257,500,000 July 10   1976 Final Crop: 287,000,000   305,000,000 May 10, 1977

<u>Discussion</u> The research on crop yields has gone beyond the "promising" stage. All of the early forecasts have been relatively good and only the late one in 1976 was in serious error. The influence of late spring and summer temperatures on the crop is the area most needing work and this is now my focus of study.

<u>Publications</u> Since last year: "The Value of Accurate Long Range Crop Forecasts". To be presented in Ibadan in April and published by the Association for the Advancement of Agricultural Science in Africa.

January 1978

Environmental Variables and Crop Production

Robert Phillips

December 6, 1977

<u>Objectives</u> To correlate environmental variables with crop production and develop a method of preparing an early, accurate forecast.

<u>Progress</u> Considerable progress has been made during the past year. Work on the effects of low precipitation has continued; it has become clear that the total amount of rainfall is not the important factor. The 1977 year was one in which temperatures were important in plant growth. A great deal of headway was made in understanding some of these plant-temperature relationships.

<u>To Do</u> More work needs to be done on some aspects of tree response to temperature. Conditions leading to the formulation of the June forecast need particular attention.

<u>Conclusion</u> I am encouraged by the accuracy of the 1977 forecasts. The system was able to respond to the dry winter and the unusual temperatures of February-March-April-May. It appears that the early forecast will be within three percent of the total crop and the June forecast within about one percent.

## THE 1977 CROP YEAR AND FORECASTS

Preparation for the 1977 forecast began in the late summer of 1976.

Late Summer and Fall Foremost in everyone's mind at that time was the drought and the possibility that it might continue. The months of August and September were cooler than normal in the Central Valley, minimizing stress damage to very young buds. October was warmer than normal, however, which could harm trees not under irrigation.

<u>Winter</u> November and December continued dry and warmer than normal; January turned cool, however. Altogether, cooling was adequate.

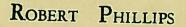
Early Spring February was warm and generally dry with plentiful sunshine; March was cool and overcast. During bloom there was good pollinating weather on a few hours of a few days for each variety. It is likely that the cool March was helpful to the crop.

Late Spring April was very warm. The forecast prepared at the end of April was for 305 million pounds. At the time this was considered to be much too high but the Crop Reporting Service followed in May with a forecast of 295 million pounds.

May was the coolest in recent history and very wet. The cooler weather allowed greater storage of photosynthate, that is, during cool weather and lower rates of respiration more of the products of photosynthesis remain with the plant. June was quite warm. The May temperatures caused me to increase the June forecast to 315 million pounds. In July the Crop Reporting Service increased their forecast to 310 million pounds. The Summer Conditions were within the normal range and had little effect on the crop. It is possible the high temperatures at the very end of July caused some minimal diminution to the crop.

Evaluation The forecasts seem to have been accurate. The early forecast seemed to respond well to the spring weather and point to a crop larger than anyone was then anticipating. May conditions dictated an even higher forecast. It appears that the early forecast will be in error by three percent and the June forecast by one percent.

<u>Conclusion</u> It seems clear that environmental variables can be used to prepare an early, accurate forecast of the almond crop. All of the early forecasts (1974-75-76-77) have been more accurate than those of the Crop Reporting Service or any others that have come to my attention. The late forecast in 1976 was short by several million pounds, however, and it remains to be seen whether the problems leading to that error have been overcome.





December 6, 1977