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EVALUATION OF REMOTE SENSING IN CONTROL OF PINK BOLLWORM IN COTTON

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Evaluation of Remote Sensing in Control of Pink Bollworm in Cotton

The main objective of this investigation is to evaluate the use of a satellite in monitoring the cotton production regulation program of the State of California as an aid in controlling pink bollworm infestation in the southern deserts.

At present CALFORM computer maps of the Imperial Valley have been produced and ground truth has been obtained for the Imperial, Coachella, and Palo Verde Valleys. Analysis of color combined ERTS data will be conducted upon receipt of data. Proposed work includes identification of cotton fields and determination of planting, defoliation, and plow-down dates.

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I. Introduction

The main objective of this investigation is to evaluate the use of a satellite in monitoring the cotton production regulation program of the State of California as an aid in controlling pink bollworm infestation in the southern deserts. It should be stressed that this is only the initial and most obvious objective. If the proposed investigation is successful, the potential of such a satellite monitoring program for agriculture is unlimited.

The most immediate potential exists in the cooperative regulation of cotton production between California, Arizona, and Mexico. Substantial areas of cotton exist in the Arizona area bordering the southern California deserts and in the areas of Mexico bordering the southern California deserts. Both of these areas represent substantial sources of pink bollworm infection for California. Therefore, if the management system imposed upon cotton producers by the California Department of Agriculture is not successful, it will be imperative to determine whether the lack of success is due to the failure of growers in California to comply with the regulations or to the fact that insects are entering the diapause in readily available sources of plant material in Mexico and Arizona and then spreading into the southern California area. If the regulatory program proves successful, it would be our intention to expand the monitoring program in ERTS-B to include surveillance of cotton production and plowdown in Mexico and Arizona.

Another application of this research could be the extension of such a management system employing satellite monitoring to other crops in California and the rest of the United States. The use of chemical pesticides for the control of insects is coming under increasing criticism, and it is recognized by scientists the world over that other means of control must be utilized whenever possible. One means of control is that of pest management, i.e., the kind of improved management that we are attempting to develop in the cotton fields of the southern California deserts. There are many other instances of crop production in the

United States, indeed the world, where insect control could be improved by removing a crop before an insect pest enters the diapause stage. Wherever such programs involve substantial acreage, the assurance that growers are cooperating in observing a regulatory schedule is imperative. The use of satellite sensing devices to provide such grower assurance could easily prove to be the simplest means of monitoring available.

Furthermore, the proposed investigation might also play a significant role in averting a far greater disaster than the current pink bollworm threat to cotton crops in southern California. Although the California desert areas produce 80,000 acres of cotton annually, the State of California in its entirety produces over 700,000 acres of cotton, the bulk of which is concentrated in the San Joaquin Valley. It is a major effort of the Federal government, the California Department of Agriculture, and the University of California to insure that pink bollworm does not spread into this area of cotton production. If such a disaster should occur, then it would be necessary to adapt a management program in the San Joaquin Valley similar to the one in effect for the southern California desert. Thus, it would become necessary to monitor the defoliation, plowdown and replanting dates for 650,000 acres of cotton rather than 80,000 acres. Obviously, it would be almost impossible to carry out such a massive management program without the development of some remote sensing system.

II. Status of Work Progress

Progress to date and future plans.

In cooperation with the Geography Department at the University of California at Riverside, a CALFORM computer map of the entire Imperial Valley is being produced. This will be the base map from which subsequent "time" maps will be produced.

With the first pass of ERTS data, each field will be coded as "cropped" or "non-cropped" and the acreage for each field will be established. On the second

pass, acreage for each field will be reestablished and changes recorded. A computer program will then compare acreages with crop types and determine the number and types of crops which might occur in a given field. The third pass will be interpreted for identification of changes in the "cropped-non-cropped" categories; i.e., if a cropped field has been harvested, or a fallow field planted. Using the crop calendar for the Imperial Valley, the computer program will then further break down what crops are in any given field according to field size and time of year. Other factors, such as soil texture and its restraints on certain crops and salinity tolerances of crops will also be considered in defining land use. Over a period of one year, it should be possible to determine crop type for each field with 90 to 95% accuracy.

The applications to the identification of cotton fields is then obvious. Since the Agricultural Code of California has established "host-free" periods (fallow periods) for the Coachella, Palo Verde, and Imperial Valleys, there should be no difficulty in determining which fields are cotton since no other crop in these valleys has the identical growing, harvesting, and fallow period.

In these three valleys, ground truth of the location of all cotton fields is available, thus checking the accuracy of the computer identification will be easily done. However, even if ground truth were not available, this method of time analysis should provide the location of 95% of the cotton fields in any area (provided that there is a defined reason for cotton) leaving only a minute area which might need to be ground checked.

Problems Impeding Progress.

Since no data has been received, only the production of the base maps and the collection of ground truth has been accomplished. There has also been a delay in receiving color infrared underflight data which has restricted the comparison of this data to ground truth or to ERTS data.

III. Significant Results

There are none due to lack of data.

IV. Managerial Information

Analysis of Progress.

When it became known that no color composite images would be supplied, and these are deemed necessary to this project, funding for this project was considered inadequate since the lack of an equipment budget prevented the purchase of a color combiner. It was not felt that a simplified rearview projection system would provide the quality needed for this project. However, through the generosity of the Geography Department at the University of California at Riverside, we will be able to utilize their color combiner and proceed with our project as planned.

Our work schedule has been seriously delayed since no data from the first four satellite passes and no color infrared underflight data have been received. Since this is a fixed price and time contract, if data continues to be seriously delayed or arrives en masse rather than at specified time intervals, delays are definitely expected to occur in the work schedule and in efforts to achieve reliability.

Operational Status.

No publications have been produced, there is no change in standing order forms; no ERTS descriptor forms are included since no data has been received; no data request forms have been made; there are no changes in personnel.