COMPREHENSIVE RESEARCH ON RICE
ANNUAL REPORT
January 1, 1980 - December 31, 1980

PROJECT TITLE: Soil Incorporation and Cropping Systems as an Alternate To Agricultural Burning.

PROJECT LEADER AND PRINCIPAL INVESTIGATOR:

D. S. Mikkelsen, Professor of Agronomy, University of California and Dr. F. E. Broadbent, cooperating.

LEVEL OF 1980 FUNDING: $3,000

OBJECTIVES OF PROPOSED RESEARCH:

1. A complete review will be made of all published and available unpublished California literature on the problems and potentials of soil incorporation of rice straw. A review of the literature and crop residue management possibilities will be provided with focus on the critical issues existing in California.

SUMMARY OF 1980 PROGRESS:

A review of the available literature has been completed and a written, documented summary has been compiled. Some additional evaluations of straw residue management under California conditions remains to be completed and should be done by February 1, 1980. The principal investigator request that the balance of unexpended funds for the project remain available for completion of the project. An outline of the project as completed to date is appended.

Rice Residue Management Evaluation

1. Background
2. Introduction
3. Importance of rice straw
4. Yield and chemical composition of rice straw
5. Ways of handling in different countries (overviews)
6. Factors affecting decomposition of rice straw
   1. Moisture supply, rainfall and humidity
   2. Temperature
   3. Microorganisms
      (nitrite oxidizer, non-sulfur purple bacteria, Azotobacter cellulose decomposer, ammonifier, denitrifiers, clostridium, molds, etc.)

4. Additional nutrients - N, P, S, etc.
5. Quality and amount of straw application
   - C:N ration, Si content, stiffness, leafy vs culm or whole straw
6. Particle size of straw
7. Location or geographical region
8. Soil properties and conditions
9. Crop varieties
10. Machinery: choppers, shredders, rotary and disks, combine straw chopper attachments, pull-type flail shredders, impact type rotary cutters, shearbar forage choppers, culticutters, etc.
11. Time or duration allowed
12. Season of incorporation
13. Cropping system
14. Management

7. Decomposition products

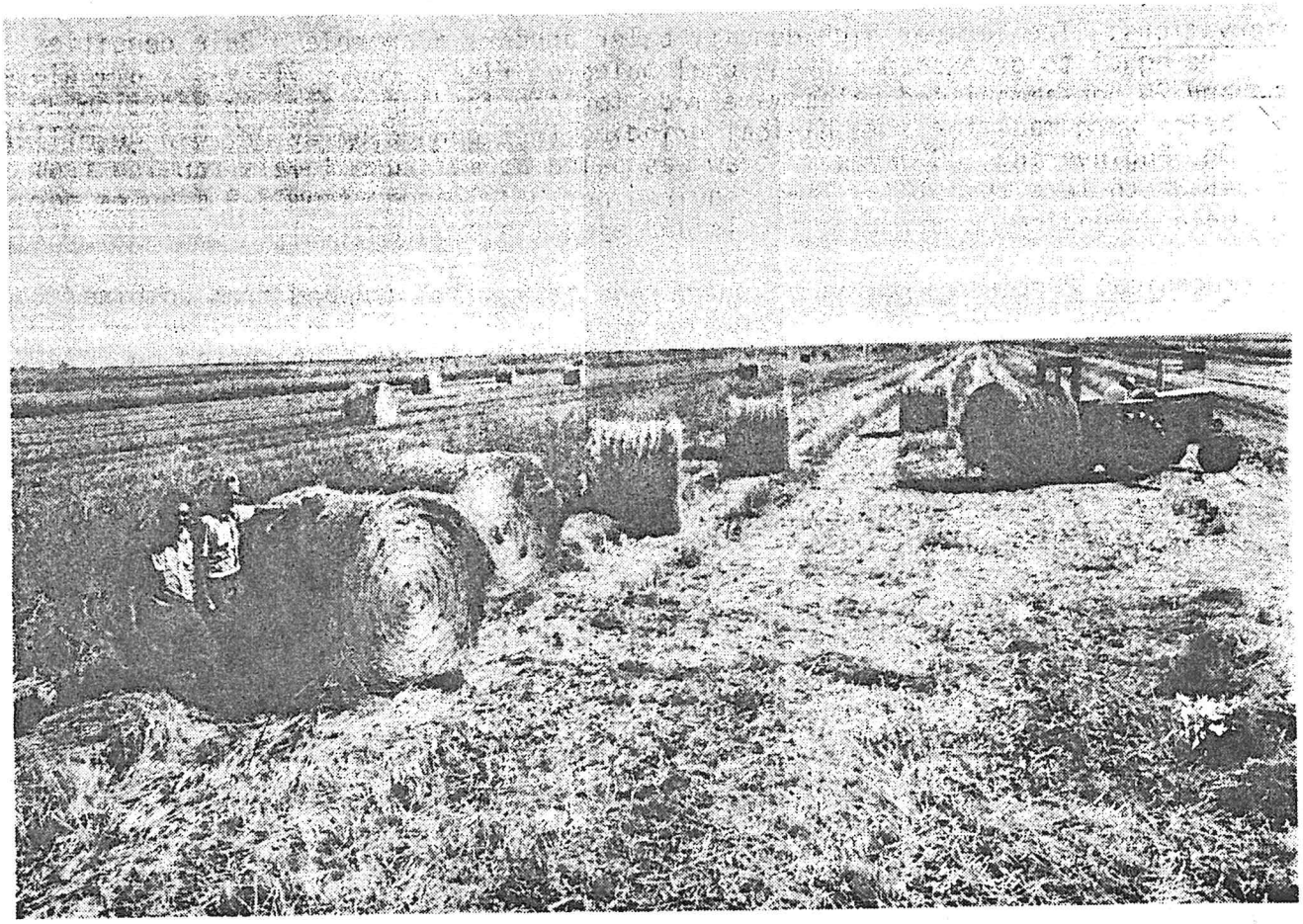
1. Anaerobic/aerobic decomposition
2. Acid products
3. Phenolics
4. Volatile gases

8. Effects of straw decomposition on:

1. Soil properties, humus content
2. Crop growth, toxicity level
3. Mineralization and immobilization
4. Amount of organic acids, phenolics and volatile gas production
5. Autointoxication
6. Plant nutrient supply
7. Degradation and activities of other agricultural chemicals, e.g. herbicides, insecticides, etc.
8. Carbon and weight loss
9. Microorganisms - types and populations
10. Nutrient losses
11. Pollution hazards
12. Growth of algae and beggiotoa
13. Diseases and insects

9. Economic aspects of straw utilization

10. Unsolved problems and future research needs.



PROGRESS REPORT

RM-7 BALER-AMMONIATION RICE STRAW

Researchers:

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Cooperators and Contributors:

Alvernaz Bros., Maxwell
Rice Research Board, Yuba City
Vermeer Manufacturing, Pella, Iowa
USS Agri-Chemicals, Atlanta, Georgia
Mansfield Assoc., Yuba City
Deere and Co., Moline, Illinois
Glenn Fertilizer, Willows
Payer Custom Chopping, Orland
Glenn Tractor, Willows
Monsanto, Los Angeles
Pure Gro, Los Angeles
Pacific International Rice Dryer, Woodland

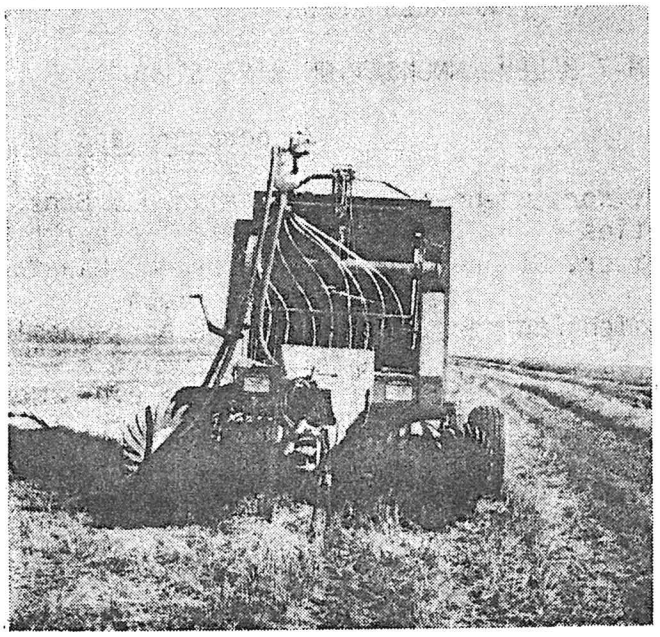
Status: Baling has been completed. Cattle feeding studies and laboratory studies regarding properties of ammoniated straw are pending.

Observations: The Vermeer high density baler appears adaptable. Bale densities are equal to or exceed conventional bales of rice straw. Sixty-six ammoniated and 79 non-ammoniated bales were made for the feeding test. In addition 30 bales were made for a mechanical grinding test conducted by Dr. George Miller, Ag. Engineering, UC Davis. Straw was baled at moisture levels ranging from 45.3% to less than 10%. Time required per bale ranged from 3-9 minutes per bale depending on moisture levels and ejection problems.

Technical Problems with Baler - Windrows at 5 - 5½' dropped from combine chute were too wide for 4' pickup mechanism to handle when heavy dew or stem moisture was present. Dry straw from wide windrows presented no appreciable baling problems when crowd wheels were used and adjusted properly.

Ejection of high moisture bales were a problem. Tapering of baler, narrower windrows, internal deflectors or a mechanical ejection system could possibly solve this problem.

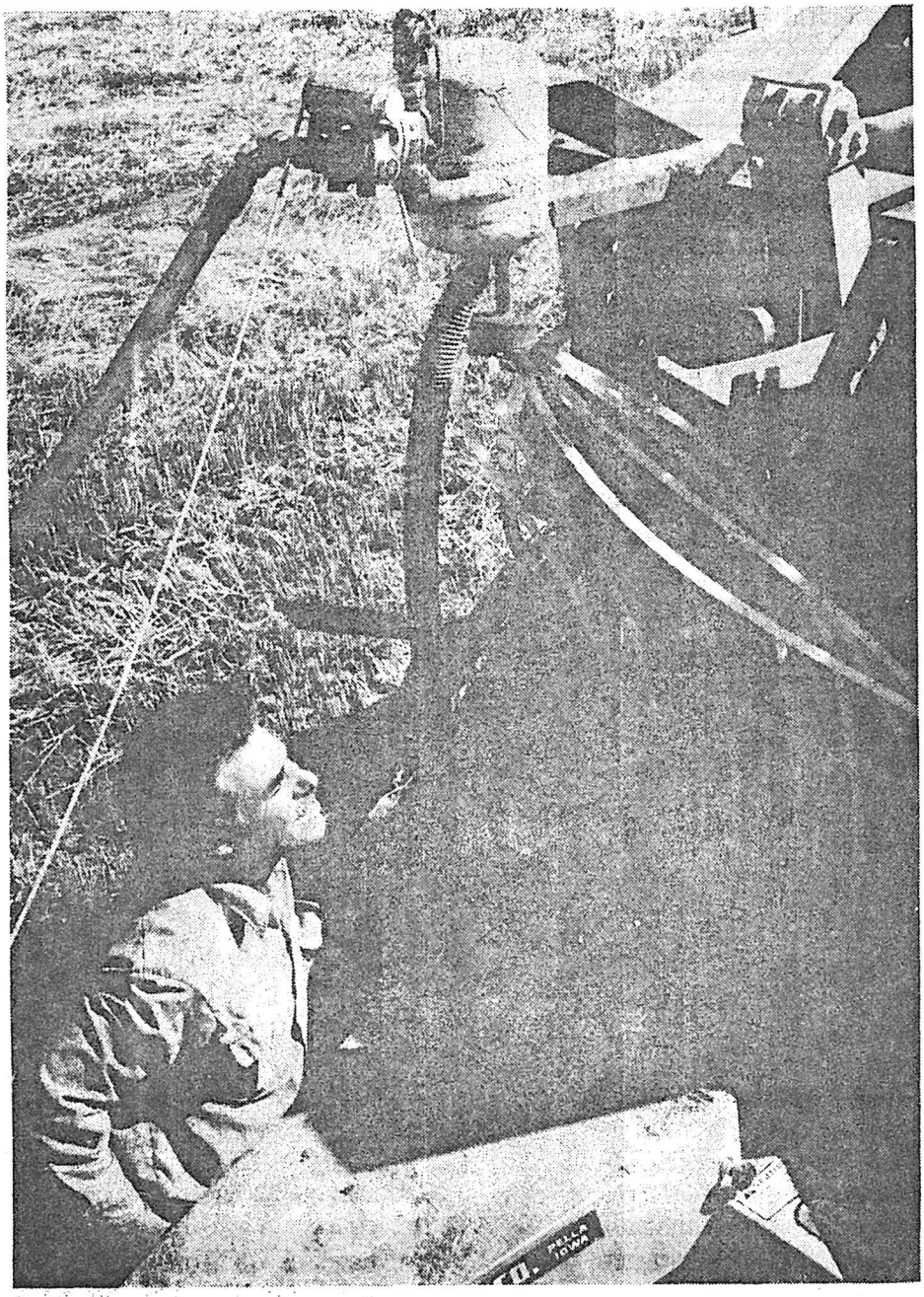
Consensus - Baler has distinct possibilities for packaging rice straw at a wide range of moisture levels.



Note crowd wheels mounted ahead of pick-up mechanism.

Technical Ammoniation Problems

Air is expelled from the round bale toward tractor. Operation of the cold-flo device requires ammonia vaporization. The NH_3 vapor caused the tractor driver severe discomfort because of the baler action, the short tongue on the baler and the air conditioners rear intake on the tractor cab. Support systems using bottled air were necessary during baler-ammoniation when there was no cross-wind. This was not totally unexpected. Possibly a change in design could avoid the problem.



Ammonia metering device, cold-flo and ammonia distribution system shown at top of photo.

Preliminary Conclusions

Ammoniation appeard uniform. Bales had little NH_3 odor when ejected. NH_3 incorporation with straw appeared to be very good. Safety equipment for tractor driver should include an available bottled air supply and a face mask. NH_3 shutoff valve should include an easily operated type. A rope pull is not recommended. Rope often becomes tangled during periods of cross-winds and is not easily accessible. The dense 4' x 5' bales are easily handled with a tractor-mounted fork lift or conventional type fork lift with a 1 ton capacity. They fit very nicely on a flat-bed trailer without being over-width.

Double stacking on heavy-duty trucks may require blocking or some special rack to prevent bales from rolling off end of truck bed as they are being loaded. Bales may need to be protected from weathering by commercially available plastic sleeves.

Preliminary observations show untreated and treated rice straw put up in the round bale soon after harvest to show good color and to be quite acceptable to cattle when fed in hay racks.

Problems Remaining Regarding Baling With Vermeer Round Baler

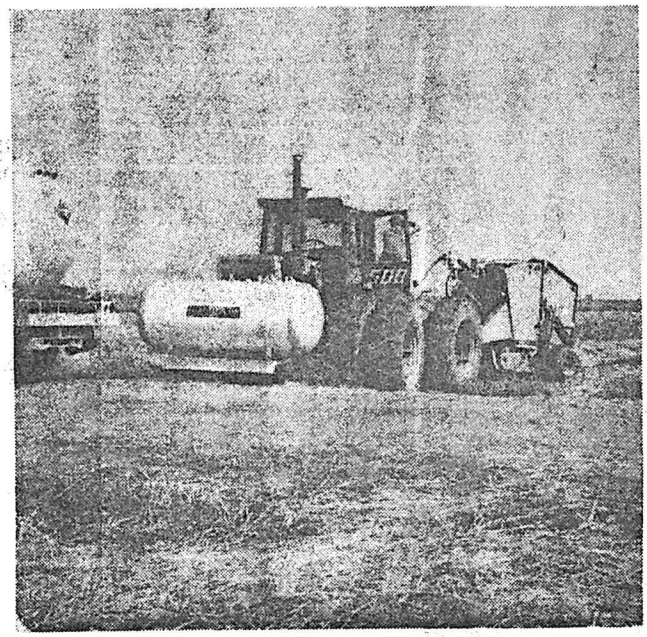
A. How to Accomplish Windrow Modification?

Possibilities:

1. Modification of combine by the addition of deflectors at straw discharge.
2. Mount V-type wheel rake on front of tractor.
3. Swath rice straw.
4. Rake rice straw prior to baling.

B. How to Improve Ejection of High Moisture Rice Straw From Round Balers?

1. Modification by tapering bale chamber. (Engineers look to this as a feasible solution.)
2. Design a mechanism to force bale from chamber (Vermeer is working on this as a possible solution).



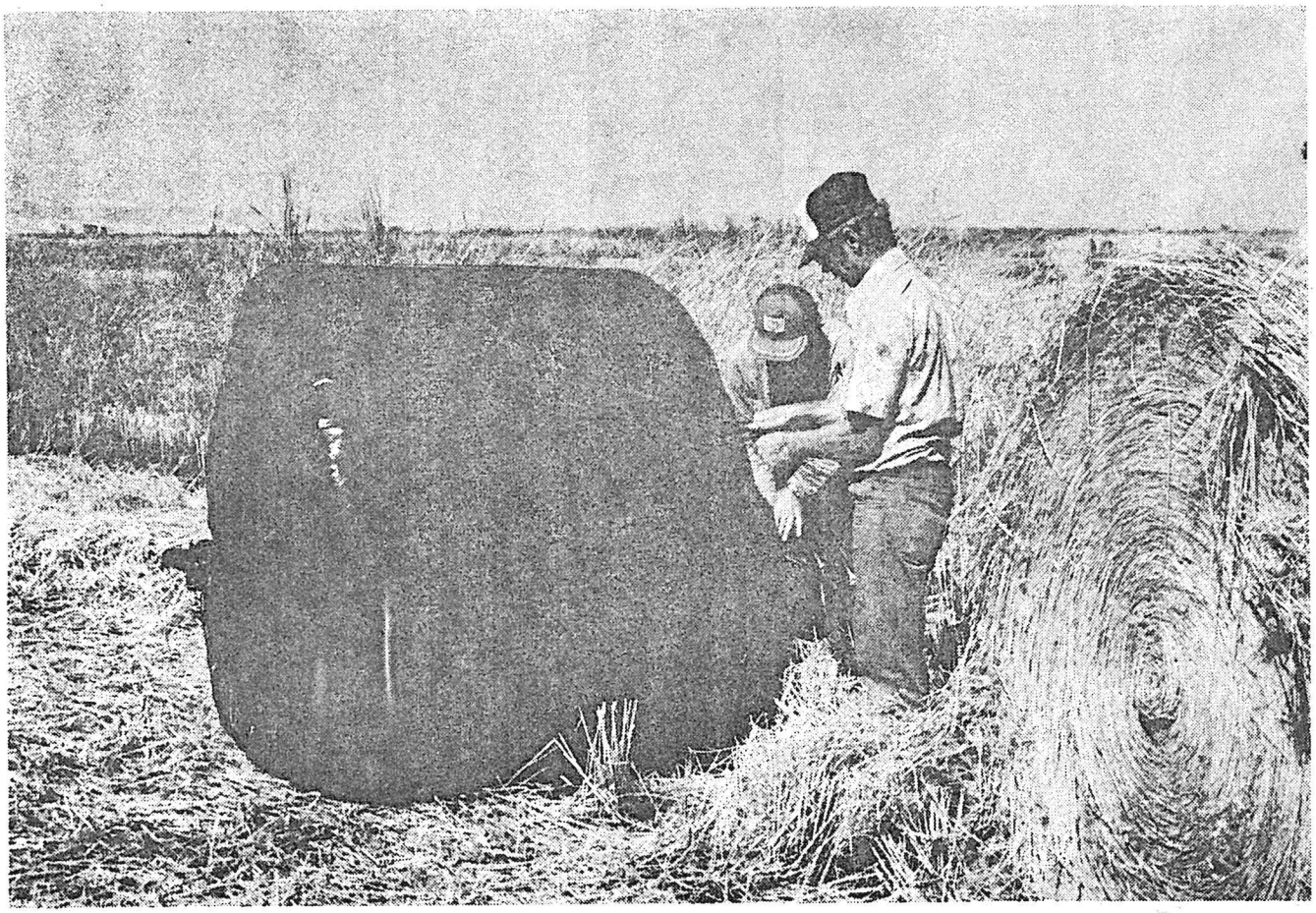
The 375 gallon tank front mounted supplied NH_3 for 44 bales.

C. How to cope with adverse weather conditions?

The Vermeer baler needs to be tested under more typical weather and field conditions than were present this fall.

D. How does the high density round baler compare with high density rectangular bales in economics and performance?

E. Is baler-ammoniation with conventional baler as effective or more effective?



Plastic sleeves for round bales are available in various lengths. Improved weathering and increased NH_3 retention may result from the use of sleeves.

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