FERTILIZER EXPERIMENTS ON RICE IN BRUMDEC (SECOND QUARTERLY REPORT)

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FERTILIZER EXPERIMENTS ON RICE IN BRUMDEC

(SECOND QUARTERLY REPORT)

BY

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1. INTRODUCTION

This report is prepared in accordance with Article 6, Section 6.01 of the Agreement between the Black River Upper Morass Development Company Limited (BRUMDEC) and the Inter-American Institute for Co-operation on Agriculture (IICA).

The period covered by this report is July 27 - October 26, 1981.

2. PRINCIPAL ACTIVITIES

The report of principal activities is presented in Table 1.

3. PROGRESS REPORT ON EXPERIMENTS

Up to the end of the period under report only fertilizer experiments have been sown. The objective of the experiments is to identify quickly the fertilizer factors which individually or in combination enhance the growth and grain production of the rice plant, and to develop response curves which can be used as guides in the planning of future experiments and in the planning of fertilization of production fields of the rice crop.

3.1 Experiment R1/1/81

Sown on August 25, 1981. This experiment tests the response of the rice plant to three levels of nitrogen, three levels of phosphate, three levels of potash, and four levels of a micronutrient mixture. The levels tested are listed in Table 2. There are 108 different fertilization treatments in this experiment. The experiment is sited on Cashew Clay. The experimental design is a randomized complete block with two replications.

This experiment has progressed satisfactorily. The experimental site is small and manual levelling was sufficiently effective in providing conditions for adequate control of irrigation water.

Table 1. Comparison of actual versus proposed work operations during the period July 27 - October 26, 1981

Operation	No. of days		Comments
	Actual	Proposed	
Land Preparation	27	50	Land preparation for two experiments in Field 9, two experiments in Field 5, and one experiment on the Morass Peat. The MF 290 tractor is not fitted with R2.0 rice and cane tyres and its output per day under the wet conditions prevailing during the period was low. The variance of 23 working days occurred when the said tractor was assigned to bush-cutting on the Morass Peat area. During that time no tractor was supplied to prepare lands for the rice research programme.
Experimental plot preparation	33	56	The time required to prepare experimental plots was longer than anticipated.Due to the difference in levels existing in the fields, large amounts of soil had to be moved manually. For the levelling of experimental plots under wet conditions a mounted back-blade is needed. Manual levelling has not provided levelled sites where the area occupied by the experiment is large.
Preparation of experimental material	10	38	Only four of fourteen experiments planned were sown during the period. Of the ten experiments not emplaced, two variety trials were delayed due to lack of seed. The remainder were delayed because no tractors were available to prepare fields.

Table 2. Levels of nitrogen (N), phosphate (P_2O_5), and potash (K_2O), and micronutrient mixture of Iron (Fe), Manganese (Mn), and Zinc (Zn) used in the fertilizer studies on Cashew Clay soil.

Level	Amount of fertilizer nutrient kg/ha (lb/ac)					
	N	P_2O_5	K_2O	Fe	Mn	Zn
0	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
1	56(50)	28(25)	30(26.8)	0.125(0.111)	0.125(0.111)	0.125(0.111)
2	112(100)	56(50)	60(53.6)	0.250(0.222)	0.250(0.222)	0.250(0.222)
3	- -	- -	- -	0.375(0.333)	0.375(0.333)	0.375(0.333)

3.2 Experiment R2/1/81

Sown on September 4, 1981. This experiment tests the grain yield response of the rice crop to the levels of nitrogen, phosphate, and potash shown in Table 2. No micronutrients were applied. We experienced problems associated with poor water control in the site due to the large differences in levels existing in this portion of Field 9.

This experiment was sampled at 21 days after sowing (21 DAS) at which time both soil and plant samples were taken from each plot. The results of the soil analysis are not yet available. Dry weight data are presented in Table 3.

Table 3. Mean plant dry weight per $900cm^2$, mean number of tillers per $900cm^2$, and mean tiller dry weight, each at 21 DAS at each of three levels of phosphate applied before sowing.

Phosphate Level/Ha		Mean Plant Dry Weight (g)/900 cm^2	Mean Tiller Dry Weight (g)	Mean Number of Tillers /$900cm^2$
Kg P_2O_5	lb P_2O_5			
0	0	3.997	0.172	23.2
14	12.5	3.929	0.176	22.3
28	25.0	5.078	0.230	22.1

At 21 DAS up to the time of sampling for dry weight measurements, only phosphate fertilizer had been applied to treated plots. The results indicate that there is a growth response by rice plants to 28 kg P_2O_5 per hectare (25 lb P_2O_5/acre) applied just before sowing on Cashew Clay. The data also indicate that initially Cashew Clay may fix applied phosphate at a rate of at least 14kg P_2O_5 per hectare (12.5lb P_2O_5/acre).

This data is presented graphically in Figure 1.

Plant samples were taken from each plot at 42 DAS for dry weight measurement and chemical analysis. The results of the dry weight measurements are presented in Figure 2. The results of the chemical analyses are not yet available. At 42 DAS up to the time of sampling, the levels of nitrogen, phosphate and potash which had been applied to treated plots are given in Table 4.

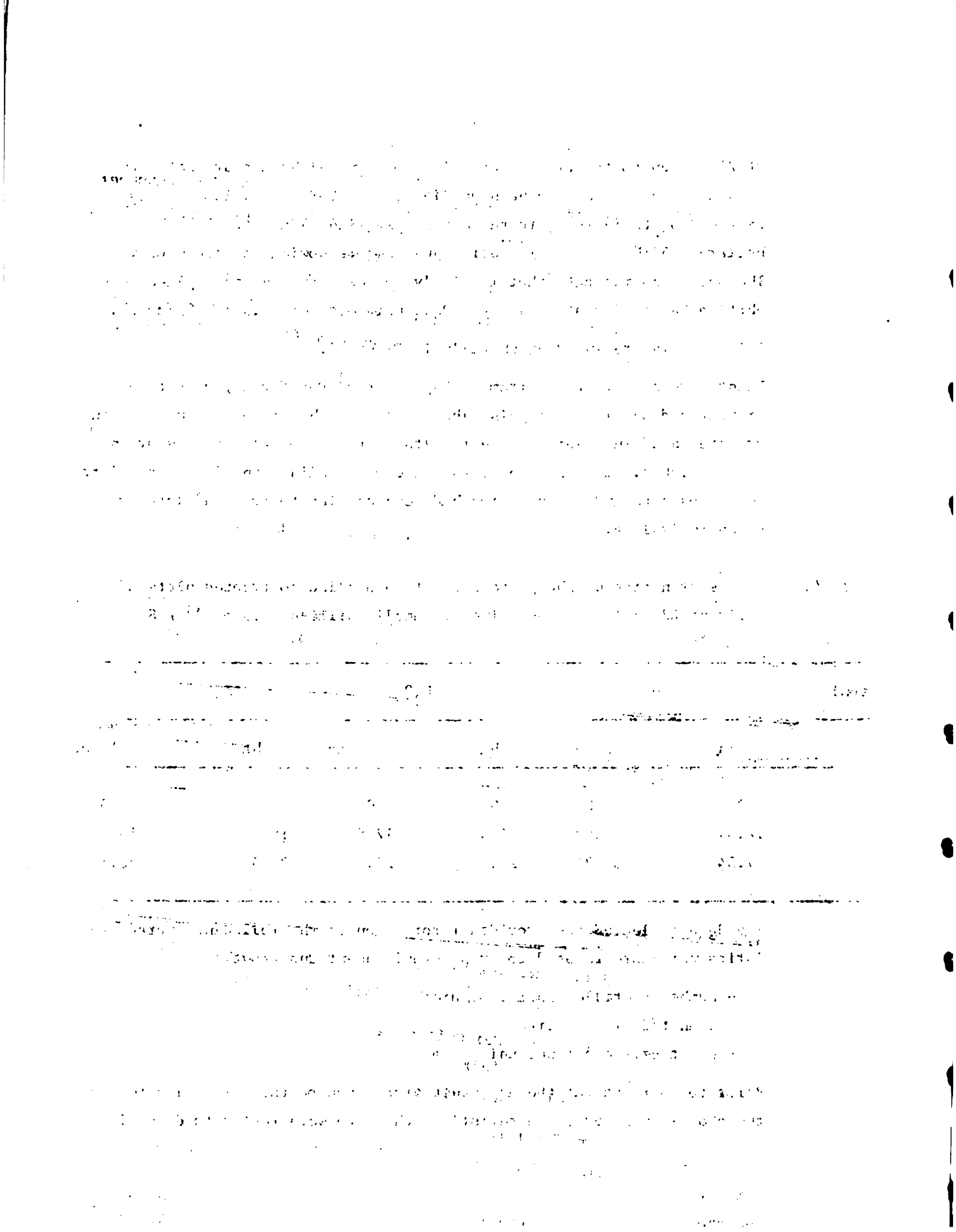
Table 4. Levels of nitrogen, phosphate and potash applied to treated plots of experiment R2/1/81 up to the time of sampling rice plants at 42 DAS.

Level	N		P_2O_5		K_2O	
	kg/ha	lb/ac	kg/ha	lb/ac	kg/ha	lb/ac
0	0	0	0	0	0	0
1	18.67	16.67	14.0	12.5	15.0	13.4
2	37.34	33.34	28.0	25.0	30.0	26.8

The data collected has provided information on the following characteristics which are related to crop establishment and growth:

- number of tillers per unit area
- mean tiller dry weight
- plant dry weight per unit area

Prior to carrying out the analyses of variance on the data collected for the above-mentioned characteristics, the data were tested to determine



whether the means of different groups of treatments were proportional. to the variances. The tests indicated that for plant dry weight per unit area and for mean tiller dry weight there was no significant linear relationship in either case, whereas for the number of tillers per unit area a significant linear relationship (Fig.3) was observed between the mean and the variance. Consequently, the data for number of tillers per 900cm^2 was transformed using the $\log_{10}$ transformation prior to carrying out the analysis of variance.

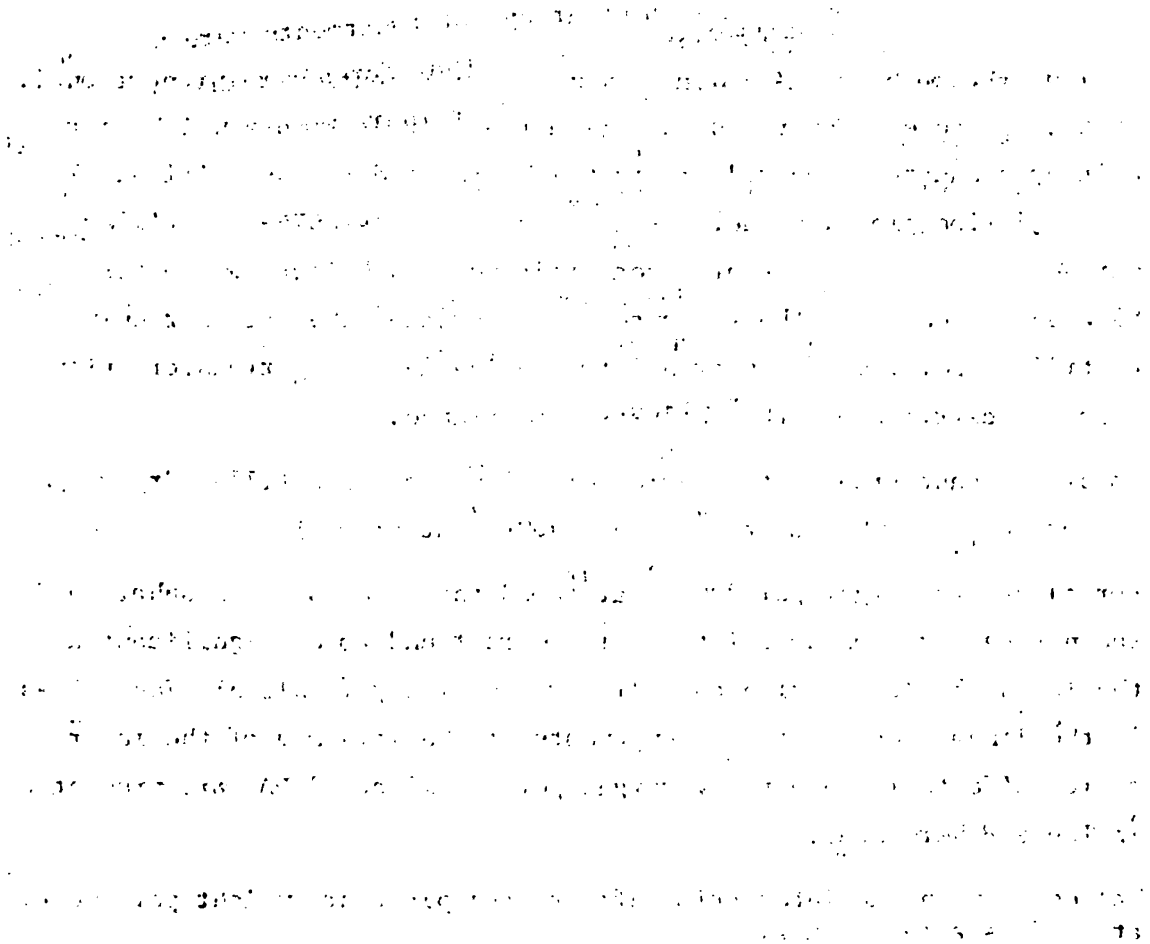
No significant treatment effects were found for mean tiller dry weight or for $\log_{10}$ (number of tillers per 900cm^2 at 42 DAS).

For plant dry weight per 900cm^2 at 42DAS the effects of phosphate and the nitrogen x phosphate interaction were found to be significant at the 1% and 5% levels of probability respectively (Table 5). The values of the linear and quadratic components of the main and of the interaction effects for plant dry weight per 900cm^2 at 42 DAS are presented in Table 8 hereunder.

Table 8. Values of main and interaction effects for plant dry weight per 900 cm^2 at 42 days after sowing.

Effect	Value/900cm^2	Effect	Value/900cm^2
N'	0.22 ± 1.08	N"P"	-1.51 ± 0.44**
N"	1.87 ± 1.88	N'K'	1.66 ± 1.32
P'	2.35 ± 1.08*	N'K"	0.88 ± 0.77
P"	-4.93 ± 1.88*	N"K'	0.37 ± 0.77
K'	1.41 ± 1.08	N"K"	-0.12 ± 0.44
K"	2.47 ± 1.88	P'K'	2.18 ± 1.32
N'P'	-0.87 ± 1.32	P'K"	-0.68 ± 0.77
N'P"	0.05 ± 0.77	P"K'	0.50 ± 0.77
N"P'	0.73 ± 0.77	P"K"	0.21 ± 0.44

N', P', K' - linear effect of N,P, and K respectively
N", P", K" - quadratic effect of N,P, and K respectively
** - significant at 1% level of probability.
* - significant at 5% level of probability..



The table of means for plant dry weight per 900 cm^2 at 42 days after sowing is presented hereunder:

Table 9. Comparison of treatment means for plant dry weight per 900cm^2 at 42 DAS.

Treatment	Sample Mean	Statistical Gp.	Treatment	Sample Mean (g)	Statistical Gp.	Treatment	Sample Mean (g)	Statistical Gp.
$n_2p_1k_2$	19.80	a	$n_2p_0k_0$	14 40	abcd	$n_2p_2k_2$	10.60	bcde
$n_2p_1k_1$	17.30	ab	$n_0p_2k_2$	14.35	abcd	$n_2p_2k_1$	10.50	bcde
$n_0p_1k_0$	16.85	abc	$n_1p_2k_1$	13.80	abcde	$n_2p_0k_2$	10.15	bcde
$n_2p_2k_2$	16.35	abc	$n_0p_2k_1$	13.20	abcde	$n_0p_0k_1$	9.40	bcde
$n_0p_1k_1$	16.05	abc	$n_0p_2k_0$	11.70	bcde	$n_0p_0k_0$	9.15	cde
$n_0p_1k_2$	14.85	abcd	$n_2p_1k_0$	11.00	bcde	$n_1p_1k_1$	9.00	cde
$n_1p_0k_2$	14.70	abcd	$n_1p_0k_0$	10.95	bcde	$n_0p_0k_0$	8.85	cde
$n_1p_1k_0$	14.60	abcd	$n_1p_0k_1$	10.75	bcde	$n_1p_1k_1$	7.90	de
$n_1p_2k_2$	14.55	abcd	$n_1p_2k_0$	10.70	bcde	$n_2p_0k_1$	6.25	e

Standard error of a treatment mean = $\pm$ 2.30

Statistical grouping based on shortest significant ranges using Duncan's Multiple. Range Test.

Up to 42 days after sowing the best treatments which showed no significant differences between them in plant dry weight per unit area were found to range in cost of material (fertilizer) from J$15.44 per hectare (J$6.25 per acre) for 14kg P_2O_5 per hectare (12.51bs P_2O_5 per acre, equivalent to 27 lbs Triplesuperphosphate per acre) to J$94.76 per hectare (J$38.35 per acre) for 37.34 kg N per hectare + 28 kg P_2O_5 per hectare + 30 kg K_2O per hectare (33.34 lbs N per acre + 25 lbs P_2O_5 per acre + 26.8 lbs K_2O per acre, equivalent to 159 lbs Sulphate of Ammonia per acre + 54 lbs Triplesuperphosphate per acre + 45 lbs Muriate of Potash per acre)

This data refers only to the growth of rice plants up to 42 days after sowing. Additional data on the growth responses and on the grain yield

responses will become available as the experiment progresses.

Thus far, the experimental data indicate that while 28 kg P_2O_5 per hectare applied prior to sowing results in a more rapid initial growth of rice plants as compared to 14 kg P_2O_5 per hectare, by 42 days after sowing no significant difference in plant dry weight per unit area could be found between those two levels of phosphate application. The data also indicate that up to 42 days after sowing only 14 kg per hectare of phosphate fertilization may be needed to promote satisfactory growth of rice plants on Cashew Clay soil. No nitrogen or potash fertilization appears to be needed up to 42 days after sowing for satisfactory growth of the rice plants on this soil type.

3.3 Experiment R3/1/81 and R4/1/81

Experiment R3/1/81 was sown on September 11, 1981. The crop did not establish properly and the experiment was re-sown on September 21, 1981. Again, establishment of the crop was poor.

Experiment R4/1/81 was sown on September 25, 1981. This crop also did not establish properly.

Regarding the difficulties experienced in establishing the crop in these two experiments, we were subsequently informed that these experiments were sited on a location where in the past it was found that the rice crop did not establish well and that surviving plants produced stunted growth. The site is located at the northernmost section of Field 5 and there are conflicting reports as to the identity of the soil type in that particular section.

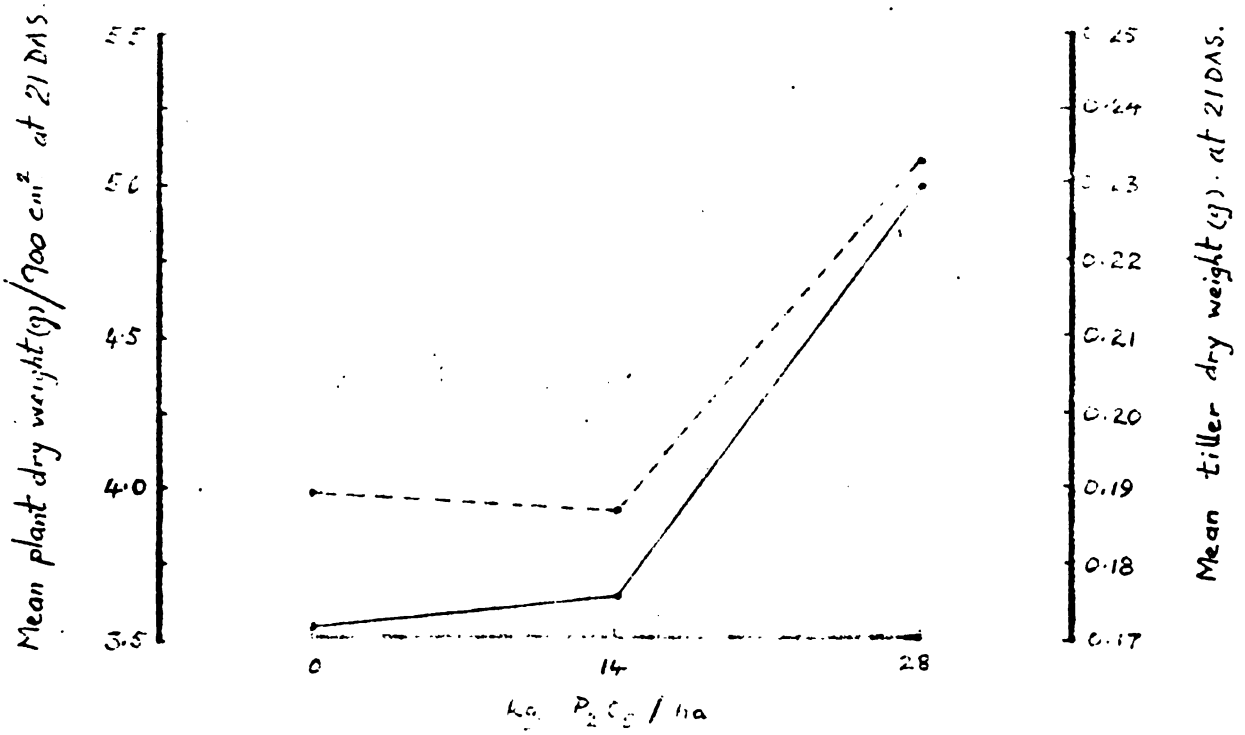
Soil samples were taken from this location and sent to the SIRI Laboratory for analysis. The results of the analysis show that the soil in this location has a mean pH of 7.48 and a zinc content of 5.25 parts per million. At those levels of pH and zinc content it is probable that the rice plant will respond positively to zinc fertilization of the order of 3.36 kg zinc per hectare (3.0lbs Zinc per acre) applied as zinc sulphate or 0.84 kg Zinc per hectare (0.75lb Zinc per acre) applied as a zinc chelate. This soil problem will be investigated as soon as land can be prepared in that location.

These two experiments were abandoned because of poor establishment of the crop.

4. COUNTERPART PERSONNEL

Mr. Oscar Bowen, a graduate of the Elim Agricultural School, was assigned to the rice team on August 10, 1981.

Mr. Andrew Nam, a graduate of the Jamaica School of Agriculture, was assigned to the rice team on August 17, 1981.



•------• Mean plant dry weight g/100 cm² at 21 DAS

•- - -• Mean tiller dry weight (g) at 21 DAS

Figure 1. Mean plant dry weight (g) per 100 cm² and mean tiller dry weight (g), at 21 days after sowing, with three levels of P₂O₅.

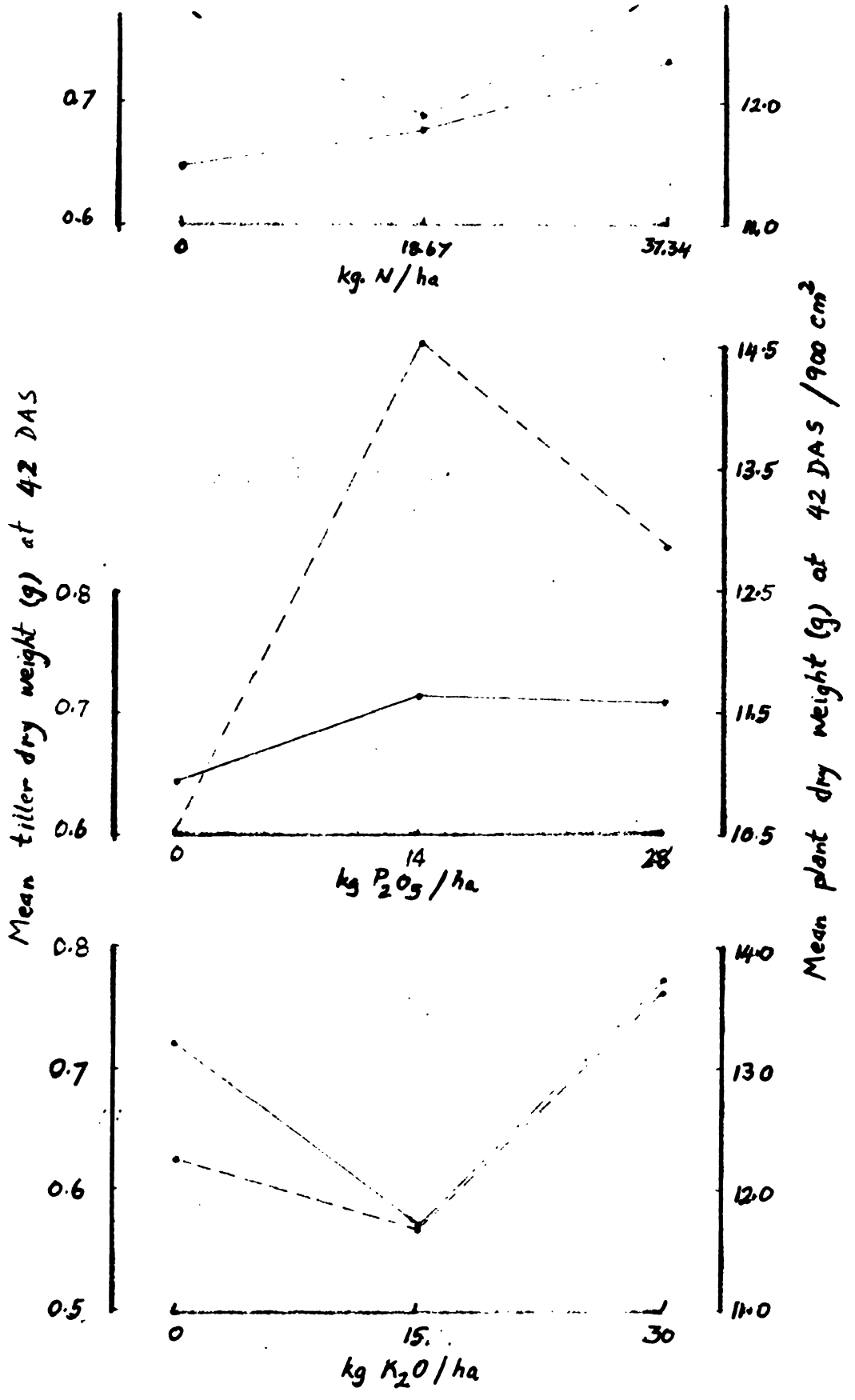


Figure 2. Mean plant dry weight (g) per 900 cm^2 and mean tiller dry weight (g) at 42 days after sowing, with three levels each of nitrogen, phosphate and potash.

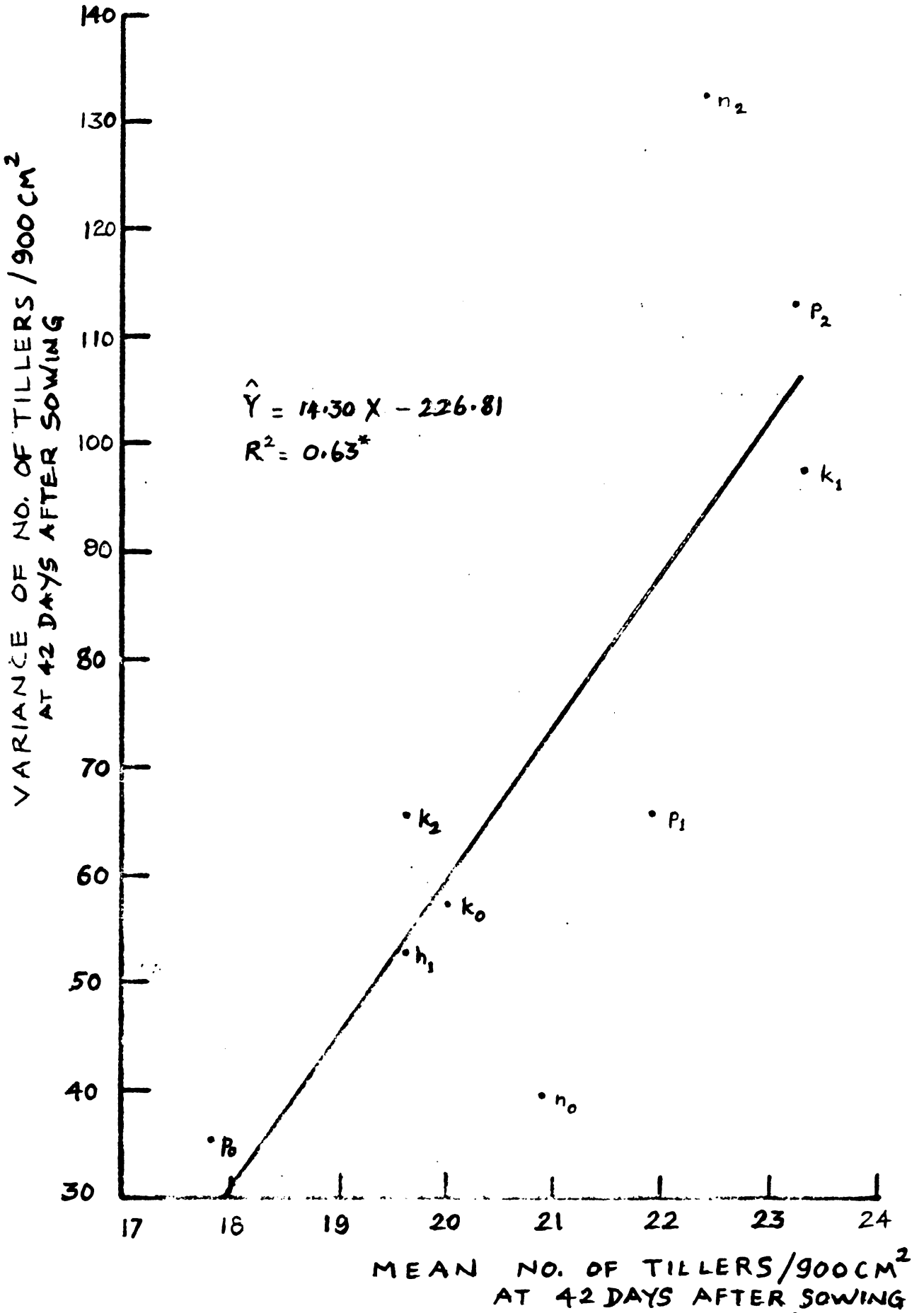


Figure 3. Relationship between mean and variance of number of tillers per 900 cm² at 42 DAS.

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No. VI - 1 Vivian Chin, "Rice Research and Production in the BRUMDEC Project State-of-the-Art Review, Identification of Constraints and Interim Recommendations and Budget for Establishing 405 Hectares (1,000 acres) of Rice on the Clay Soils at BRUMDEC". January 1982.

No. VI -2 Vivian Chin, "Programme of Work for the Short-Term Adaptive Production-Oriented Research on Rice in the BRUMDEC Project", January 1982

No. VI - 3 Claude Grand-Pierre, "Adaptive Research for Grain Production (BRUMDEC) - A Short-Term Programme", January 1982

No. VI - 4 Claude Grand-Pierre, "Experimental Procedures for Grain Crops Research in the BRUMDEC Project", January 1982

No. VI - 5 Charles Kennard, "Summary of the Proposed Programme of Work for Adaptive Production Oriented Research (Short-Term) in Vegetable Production in the BRUMDEC Project", January 1982

No. VI - 6 Charles Kennard, "Vegetable Production (BRUMDEC) - Review and Proposed Short-Term Adaptive Production Oriented Research Programme", January 1982.

No. VI - 7 Dr. Bo-Myeong Woo, "Olive River Run-Off Plots - Description of the Experiment", January 1982

No. VI - 8 Vivian Chin, "Fertilizer Experiments in BRUMDEC (Second Quarterly Report)" January 1982

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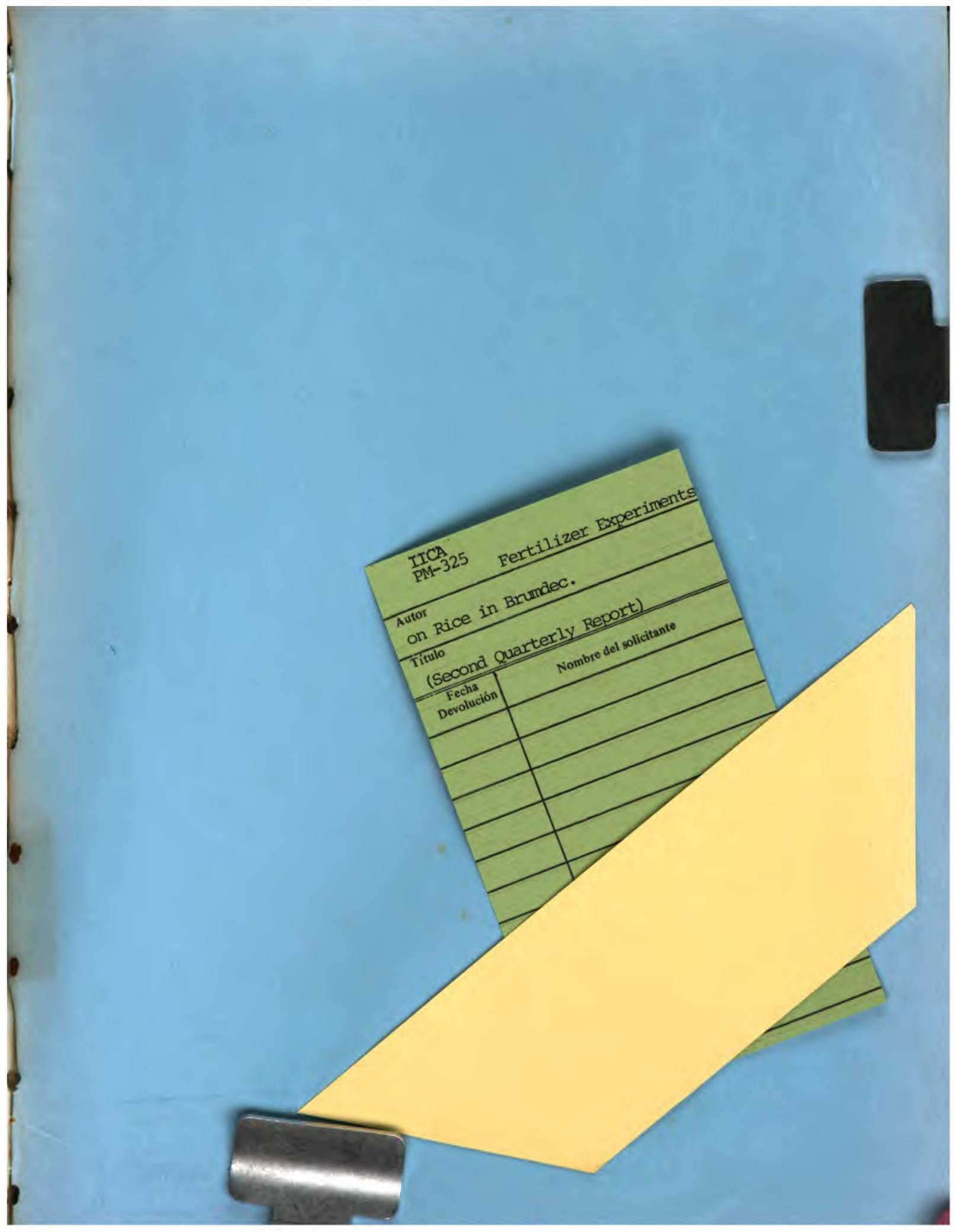
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