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

IICA/JAMAICA
Miscellaneous Publication #315
ISSN-0534-5391

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

by

VIVIAN CHIN
IICA/JAMAICA
Rice Production Specialist

January 1982

00000432

FOREWORD

On December 19,1980, an Agreement was signed between the Black River Upper Morass Development Company Limited (BRUMDEC) and the Inter-American Institute for Co-operation on Agriculture (IICA) for the provision by IICA of five consultants who would operate in the areas of rice production, grain crop production, vegetable crop development, irrigation and drainage management, and farmer organization.[a]

The BRUMDEC Project is being financed by the Inter-American Development Bank (IDB), and the Government of Jamaica. [a]

BRUMDEC is the executing agency for the Project which concerns the development of some 4,450 hectares of land in the Elim and Barton Isle areas of St. Elizabeth. [a]

The Project requires initially a state-of-the-art survey of rice research and production in the Project area.

The survey was done by the writer with the assistance of IICA Professional Staff, staff of the Ministry of Agriculture, and staff of BRUMDEC.

The objective of this document is to present the current state of technology used in rice production in the Project area, and to identify the constraints to greater productivity and utilization of the Project lands for rice production.

The writer wishes to acknowledge with thanks the assistance received from Dr. Percy Aitken-Soux (IICA-Jamaica), Dr. Abdul Wahab (IICA-Jamaica), Dr. Irving Johnson (IICA-Jamaica), Mr. Percy Miller

---

(a) Half Yearly Report Black River Upper Morass Development Company Limited. February 1981.

(Ministry of Agriculture-Jamaica), Mr. Ed Martin (Ministry of Agriculture-Jamaica), Dr. Basil Collins (Ministry of Agriculture-Jamaica), Mr. P. Rampair (Ministry of Agriculture-Jamaica), Mr. Charles W. Hewitt (Consultant Agronomist to BRUMDEC), Mr. Moses Leader (former Project Manager, BRUMDEC), and other associated personnel of BRUMDEC.

This review identifies the current levels of technology and productivity of rice in the Project area and permits ex-post facto comparisons to be made during the period of this consultancy.

Vivian Chin
Rice Production Specialist
IICA/Jamaica. January 1982

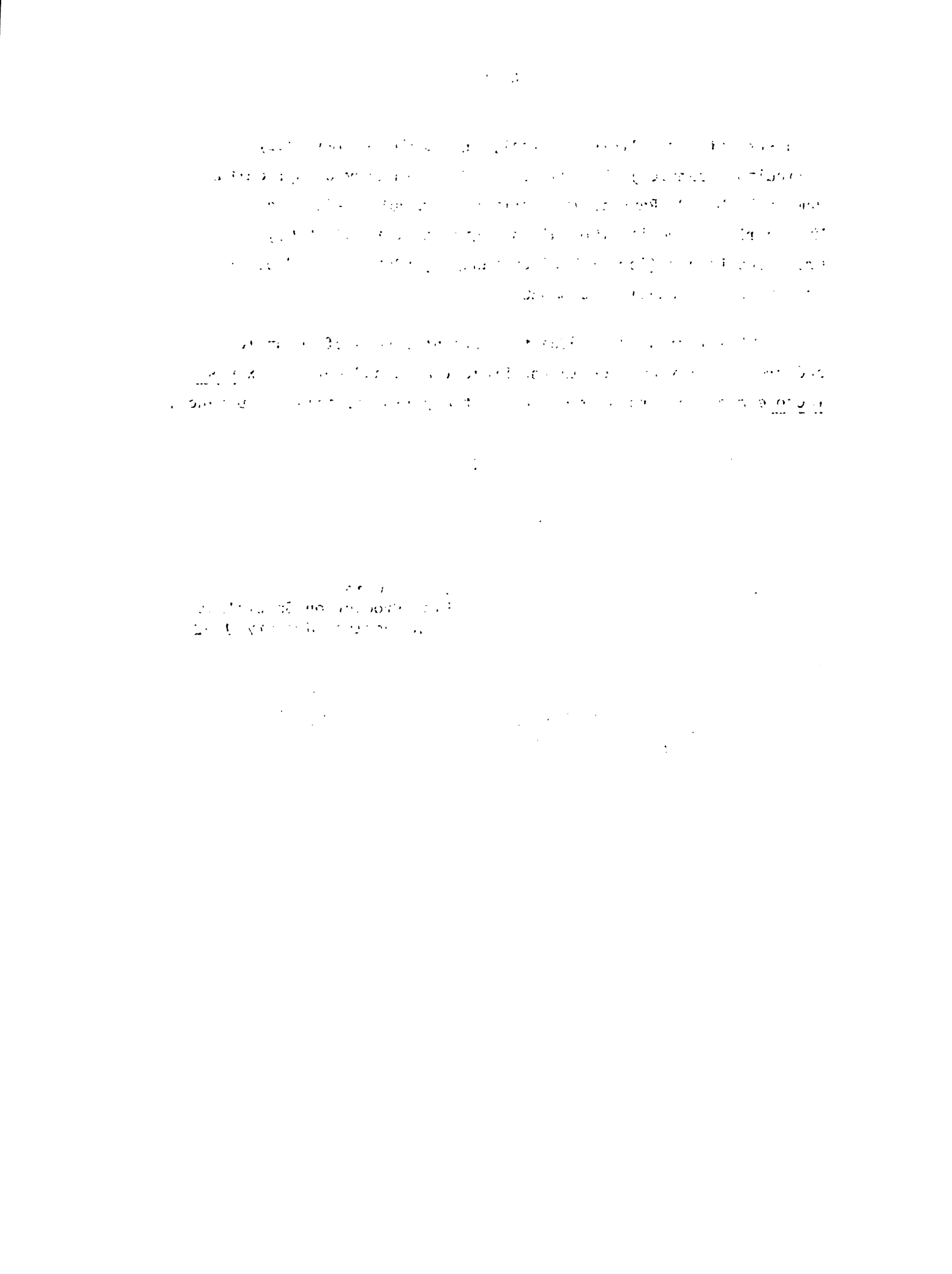
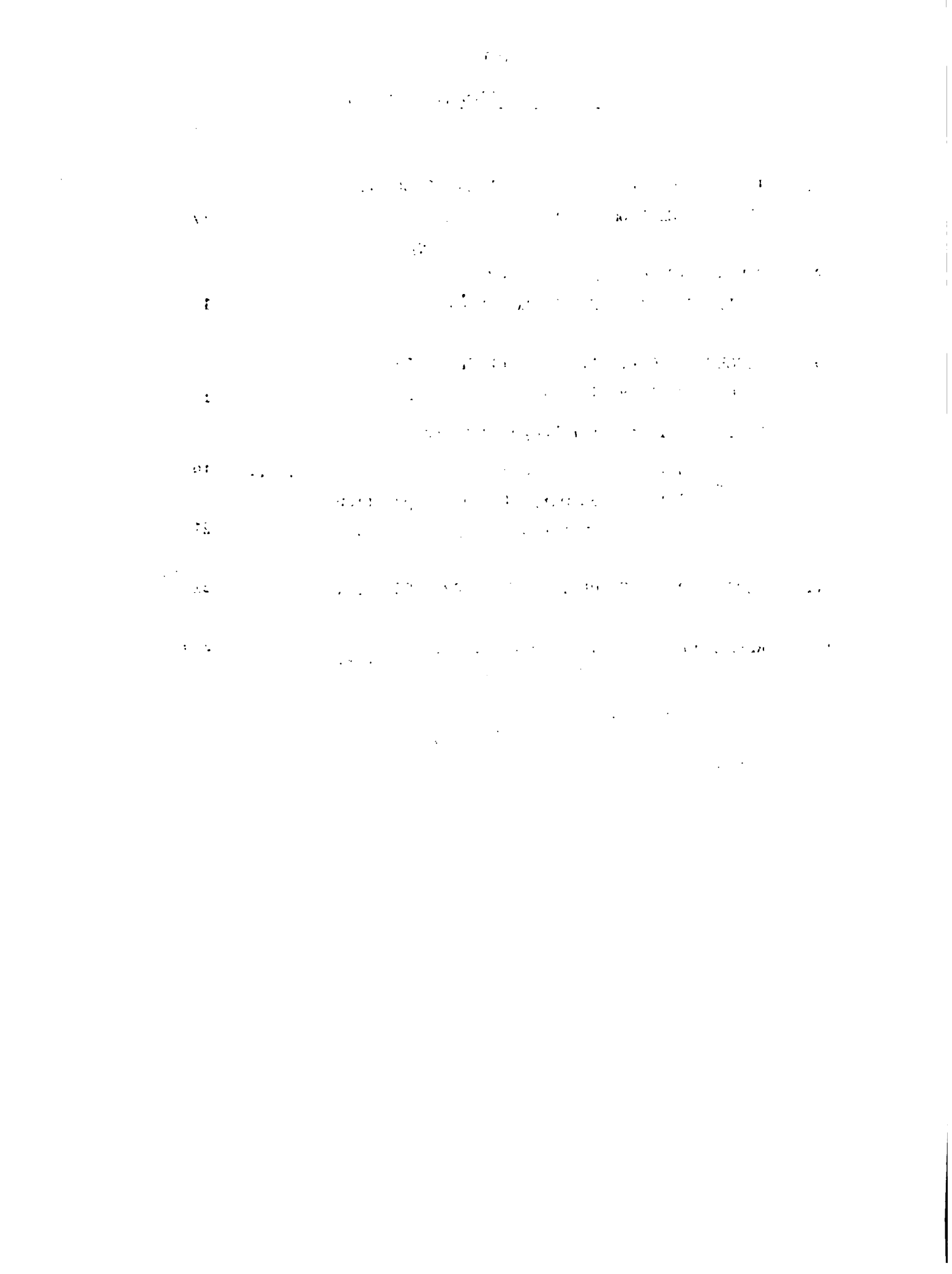


TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)



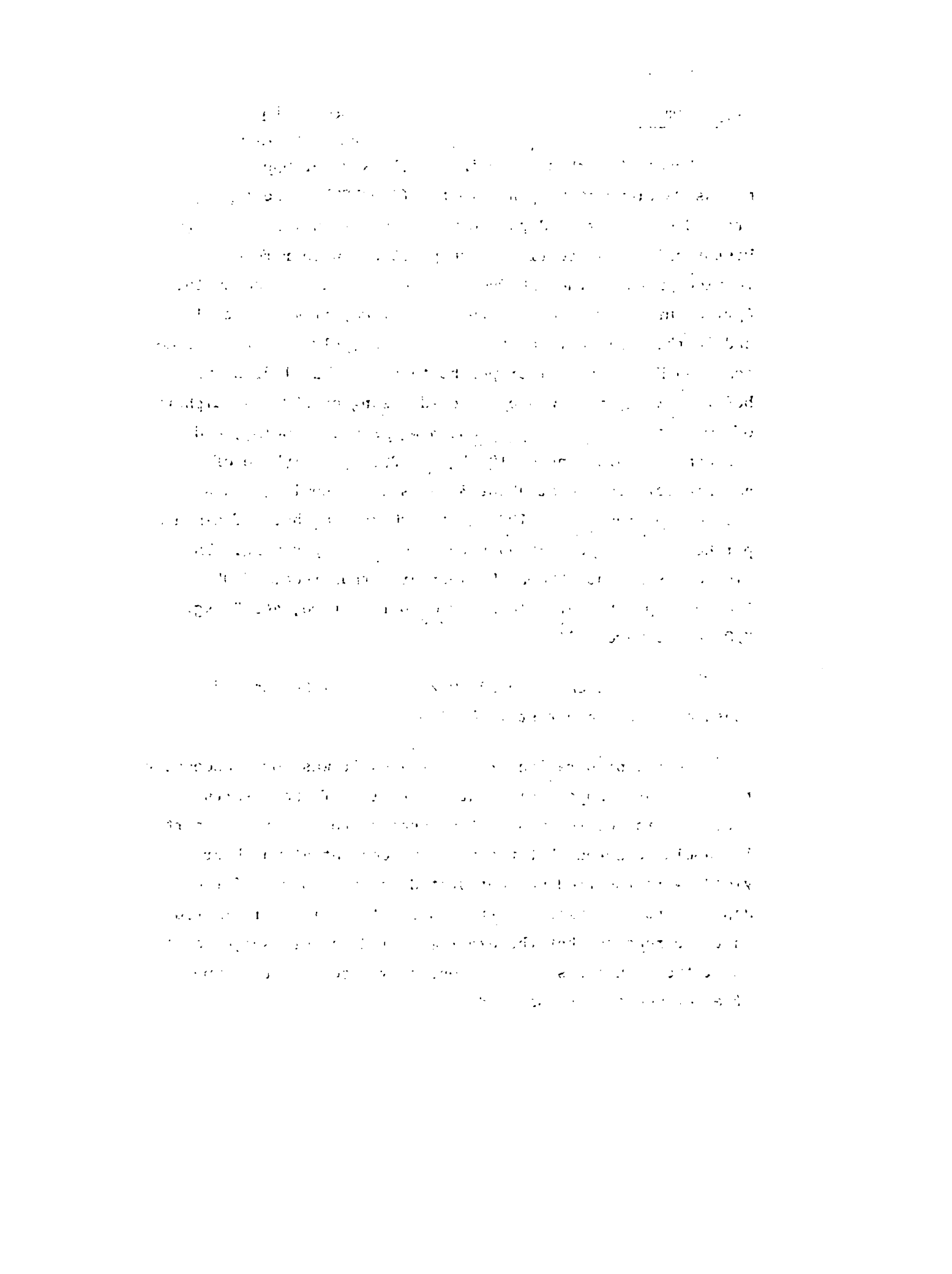
LIST OF TABLES

1. INTRODUCTION

Research work on rice in the Black River Upper Morass Development Company Limited (BRUMDEC) Project was started by a team of Japanese rice experts in 1976. Historically, the fertilization practices with references to rice grown at the BRUMDEC site when it was farmed by the Agricultural Development Corporation (ADC) from 1974 to 1977 and in the early days of BRUMDEC was to apply 200 kg. 16:9:18 compound N:P:K fertilizer per hectare as a basal dressing before sowing, followed by a top-dressing of 200 kg. sulphate of ammonia per hectare at about 3 weeks after sowing, and a second top-dressing of 100 kg. to 200 kg. sulphate of ammonia per hectare at about 3 weeks after sowing, and a second top-dressing of 100 kg. to 200 kg. sulphate of ammonia per hectare at about 55 days to 60 days after sowing. The rice crops in the BRUMDEC Project area thus received 95 - 116 kg. N per hectare, 18 kg. P_2O_5 per hectare, and 36 kg. K_2O per hectare. (1)

In 1977, CICA 9 and IR930-2 x IR665-31-6-5 passed consumer acceptance tests. (2)

In the preparation of this review it was found necessary to carry out a superficial interpretation of the results presented in the reports of the Japanese team of rice experts. It should be noted that the moisture content at which grain yields were reported was not stated in the reports of the Japanese team of rice experts. Also, there is no indication in those reports that the experimental data were subjected to statistical analyses, and no mention was seen of the types of experimental designs used.



2. RESEARCH AND PRODUCTION RESULTS OBTAINED BY THE JAPANESE TEAM OF RICE EXPERTS

2.1 Observation Plots

In the second quarter of 1978, the Japanese Team reported 3 unreplicated observation plots of CICA 9 ranging in size from 0.056 hectare to 0.37 hectare which were direct-seeded or transplanted with 13-day old seedlings or 29-day old seedlings. (3) The yield of paddy ranged from 4.5 tonnes per hectare when 13-day old seedlings were used for transplanting. The plot transplanted with 29-day old seedlings yielded 5.1 tonnes per hectare. In this trial a 0.062 hectare plot of CICA 4 transplanted with 23-day old seedlings produced 4.6 tonnes of paddy per hectare. No details of cultural practices were reported.

In the third quarter of 1978, a 0.4047 hectare plot of CICA 9 which had been transplanted with 22-day old seedlings yielded 5.2 tonnes of paddy per hectare. (4)

No information was seen on the fertilizer practices carried out in the observation trials reported in the quarterly reports of the Japanese Team for the period April 1 to December 31, 1978. However, the "Report on the Co-operated Rice Expansion Project in Jamaica" (5) gives the fertilizer usage in the test of 90 cultivars of rice as being equivalent to 42 kg. N per hectare, 34.5 kg. P_2O_5 per hectare, with no potash.

2.2 Results of Variety Trials obtained by the Japanese Team of Rice Experts from Replicated Tests (5)

In 1977, within the early maturing group of varieties, the cultivars tested under transplanting culture were RD 9, CICA 4, IR930 x IR532, IR26, RD3, IR880-C9, and RD 7, fertilized at the rate 35.84 kg. N

per hectare, 20.16 kg. P_2O_5 per hectare, and 40.32 kg. K_2O per hectare. The mean yields of paddy of the different cultivars ranged from 2.4 tonnes per hectare with RD 7. No plant protection against pests and diseases was practiced, but rotary weeding and hand-weeding were done. Hills were spaced 25 cm. x 25 cm. with three seedlings planted per hill.

In 1978, within the early maturing group, the cultivars tested under transplanting culture were CICA 4, IR26, RD 9, IR2153-43, IR36, and IR2070-464. Fertilizers were applied at the rate of 63 kg. N per hectare, 34.5 kg. P_2O_5 per hectare, with no potash. No plant protection was carried out against pests and diseases. Weed control, spacing distances and number of seedlings per hill were the same as was used in the 1977 test. The mean yields of paddy ranged from 3.51 tonnes per hectare with IR2153-43 to 5.2 tonnes per hectare with CICA 4. The 1977 trial was sown on February 15, and the 1978 trial on June 22 - 23.

In 1977, within the medium maturing group of varieties, the cultivars tested under transplanting culture were CICA 9, Naylamp, IR442-2-58, IR930 x IR665, Boewani, RD 1, and Caribe No. 1. Fertilizers were applied at the rate used in the 1977 early maturing group test. The mean yields of paddy ranged from 4.25 tonnes per hectare with Naylamp to 6.84 tonnes per hectare with Boewani. CICA 9 produced 6.07 tonnes per hectare in that test.

In 1978, the cultivars tested in this group under transplanting culture were CICA 9, IR930 x IR665, Naylamp, Boewani, RD 3, RD 7, IR442-2-58, IR2793-80-2, IR2058-78-1 and IR2071-88-8. Fertilizers were applied at the rate used in the 1978 early maturing group test. The mean yields of paddy ranged from 3.23 tonnes per hectare with IR442-2-58 to 5.69 tonnes per hectare with Boewani. In that test CICA 9 produced 4.42 tonnes per hectare.

2.3 Results of a yield Trial of four Reselected lines of CICA 4 obtained by the Japanese Team of Rice Experts.[6]

The highest mean yield of paddy obtained in this trial was 3.36 tonnes per hectare from line 4-3-1. The trial was fertilized at the rate of 50.1 kg. N per hectare, 20.8 kg. P_2O_5 per hectare, 33.6 kg. K_2O per hectare, of which 37.5 kg. N per hectare together with all of the phosphate and potash were applied as a basal fertilizer dressing before transplanting, and 12.6 kg. N per hectare applied as a top-dressing 47 - 48 days after transplanting.

2.4 Results of a Yield Trial of three Reselected Lines of Naylamp obtained by the Japanese Team of Rice Experts [6]

Cultural practices were as stated in 2.3 above. The mean yields of paddy ranged from 3.41 tonnes per hectare to 4.27 tonnes per hectare.

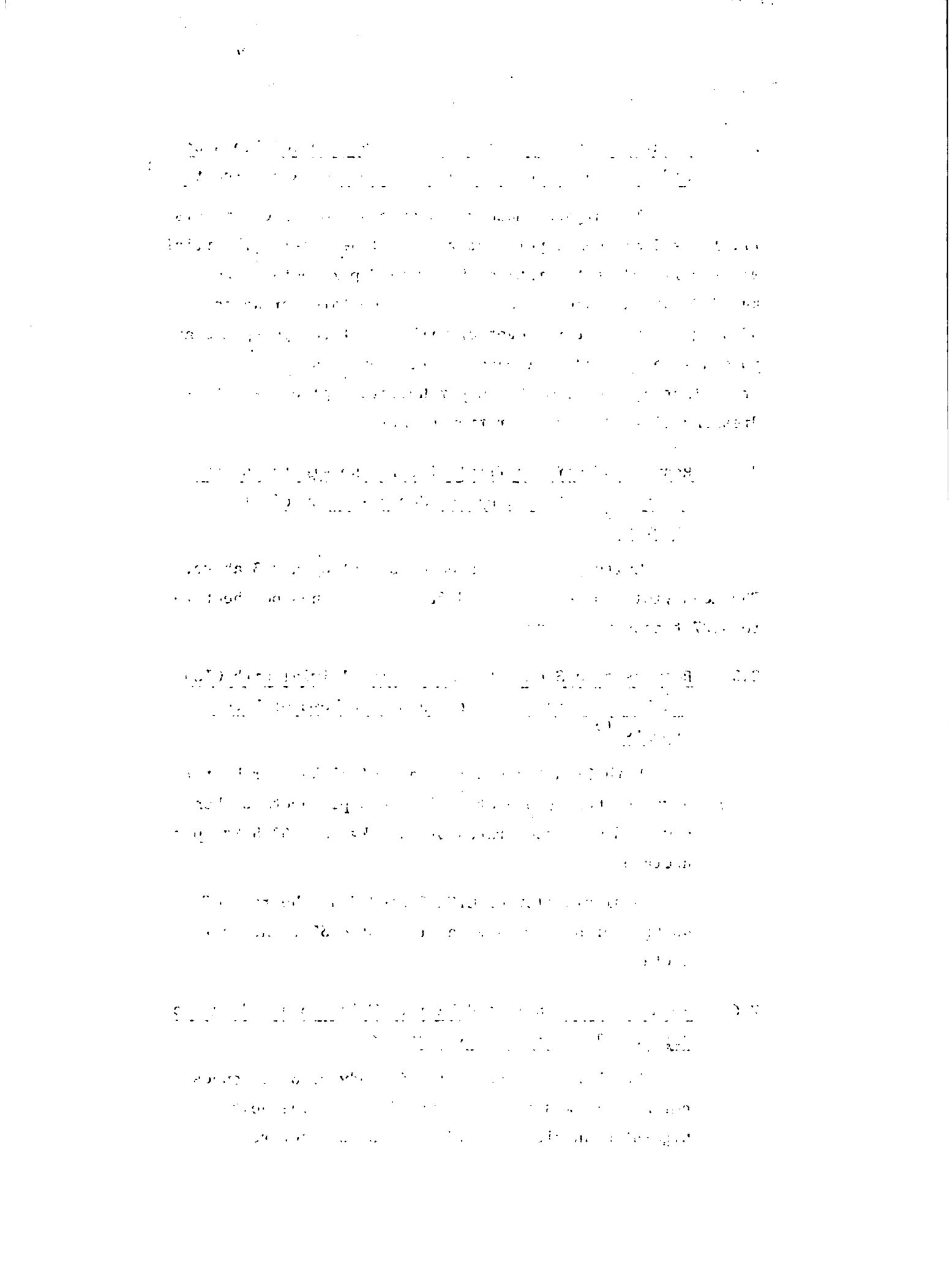
2.5 Results of a Seed-rate Observational Trial with CICA 4 and CICA 9 obtained by the Japanese Team of Rice Experts [6]

With CICA 4 a seeding rate of 45 kg. per hectare gave the best yield of 4.12 tonnes per hectare when compared with seed-rates of 56.5 kg. and 67.5 kg. per hectare.

A single plot of CICA 9 seeded at the rate of 40 kg. per hectare gave a yield of 4.35 tonnes per hectare.

2.6 Results of a Replicated Variety Trial obtained by the Japanese Team of Rice Experts [7]

The highest mean yield of paddy of 6.43 tonnes per hectare was obtained from CICA 8. The next highest mean yield of 6.22 tonnes per hectare was



produced by the reselected line CICA 9-3. This trial was fertilized at the rate of 77.4 kg. N per hectare, of which 39.6 kg. N per hectare and all of the phosphate and potash was applied as a basal dose prior to transplanting, followed by 25.2 kg. N per hectare top-dressed at 65 days after transplanting.

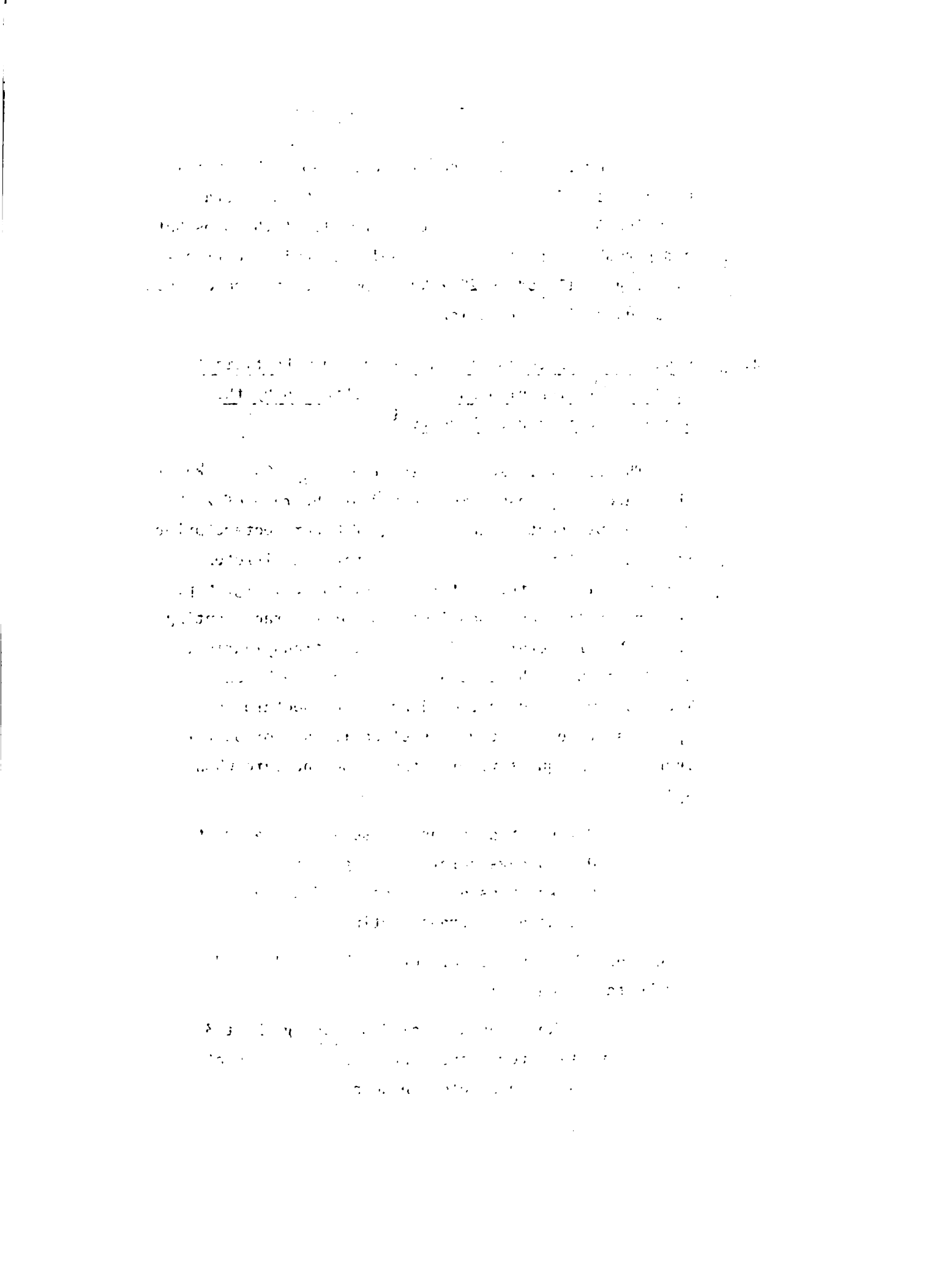
2.7 Results of a Rate and Timing of Nitrogen Fertilization Study under Transplanting Culture Obtained by the Japanese Team of Rice Experts (7)

The cultivar used in this trial was CICA 9. Basal phosphate and potash were applied at the rate of 28.8 kg. P_2O_5 per hectare and 33.6 kg. K_2O per hectare prior to transplanting. The rate and timing of nitrogen fertilization of the best treatment was 28.4 kg. N per hectare applied as a basal dose prior to transplanting, 12 kg. N per hectare at 3 weeks after transplanting, and 24 kg. N per hectare at 25 days before heading. The test indicated that 64.4 kg. N per hectare when split as stated above was as effective as, or better than the same quantity of nitrogen per hectare when split:

- 40.4 kg. N as a basal dose and 24 kg. N at 20 - 25 days before heading; or
- 40.4 kg. N as a basal dose and 24 kg. N at 3 weeks after transplanting;

or was as effective as, or better than 76.4 kg. N per hectare when split:

- 40.4 kg. N as a basal dose, 24 kg. N at 3 weeks after transplanting and 12 kg. N at 20 - 25 days before heading.



2.8 Consultant's comments on the results obtained by the Japanese Team of Rice Experts

Most of the results reviewed were obtained under a system of transplanting. The cultivation of rice using a transplanting system does not readily merge with the socio-economic conditions existing in rice farming in the Project area.

The mean of the best paddy yields obtained in the separate studies reviewed for the period 1977 - 1980 is approximately 5.3 tonnes per hectare with a range of 3.36 - 6.84 tonnes per hectare.

The mean of the best paddy yields obtained in the separate studies was found to decline from 6.1 tonnes per hectare in 1977, to 5.6 tonnes per hectare in 1978 and 4.6 tonnes per hectare in 1980.

On the premise that management of the experiments had not deteriorated over the years, it seems that there is a clear trend of paddy yield declining with time.

When that downward trend in yield from 1977 to 1980 is considered vis-a-vis the upward trend in the quantity of fertilizer used per hectare over the same period on those studies (mainly variety testing) from which the yields are reported (Table 1.), the indications are that other factors which fall outside of the scope of the management applied may now have become factors limiting the yield of the rice crop. One of the factors which may now limit the yield of the rice crop in the Project area is the Brown Leaf Spot disease of rice. The writer has observed severe infestation of this disease on rice growing in the Project area.

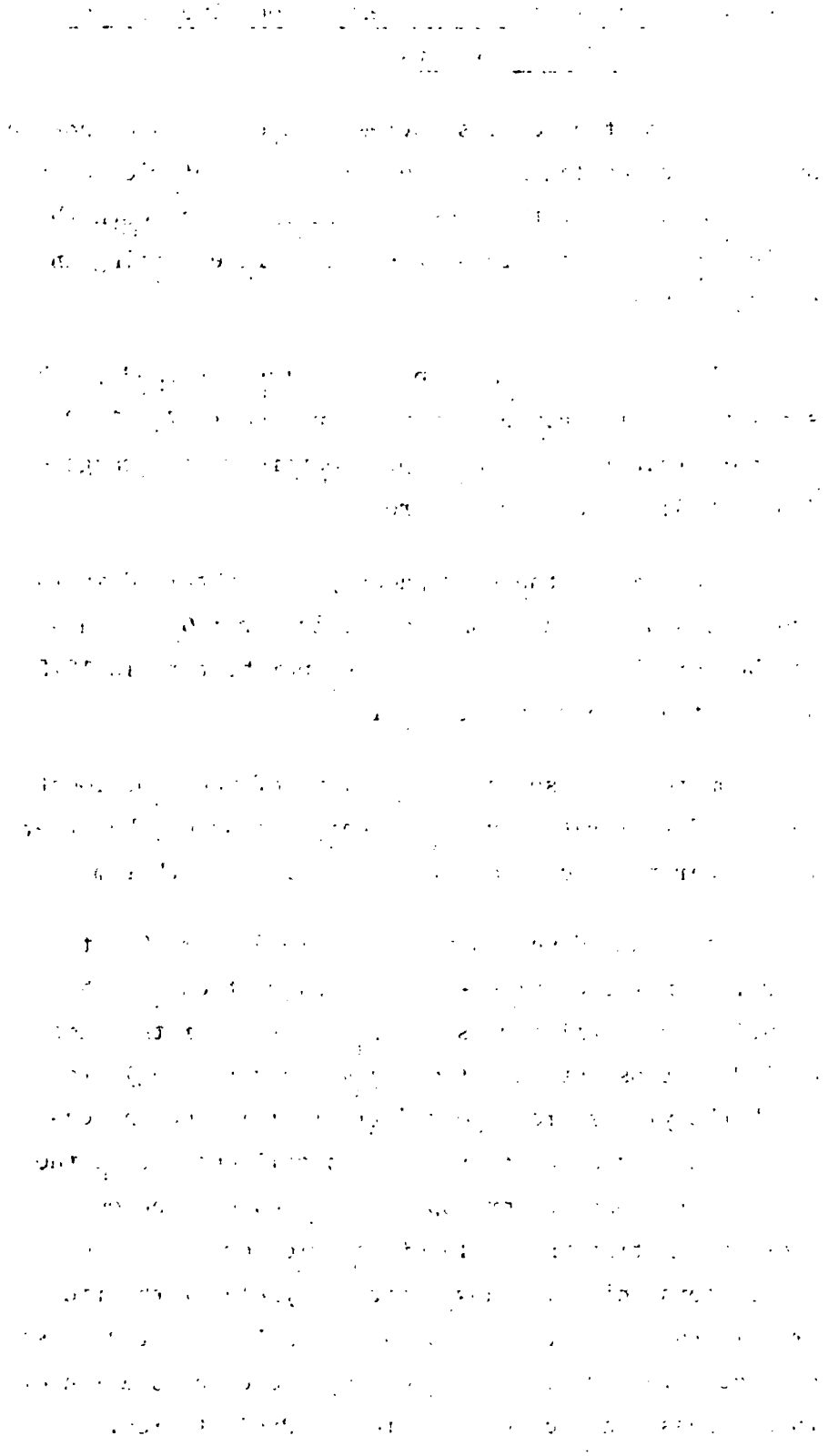
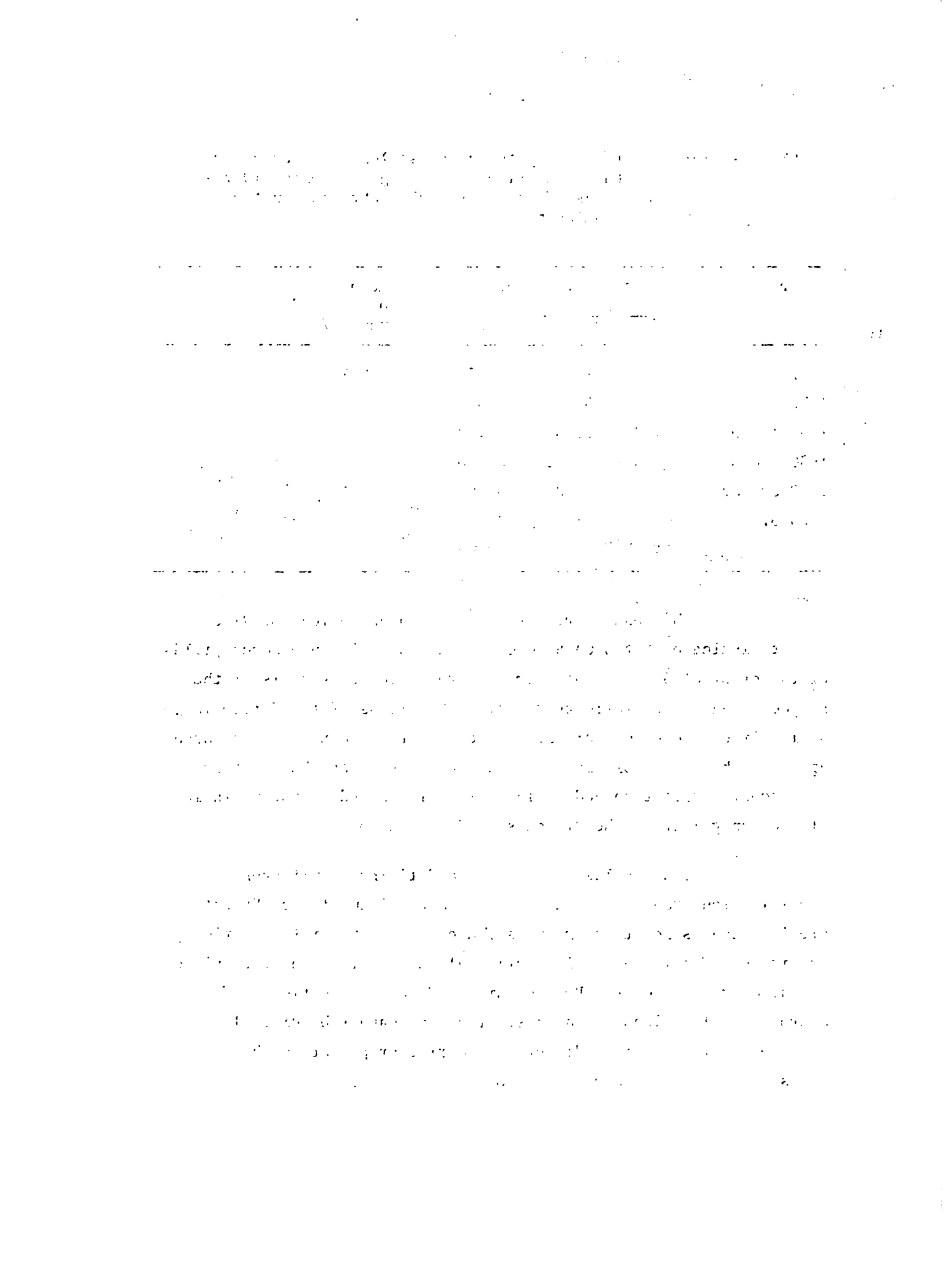


TABLE 1. - Fertilizer usage by the Japanese Team of Rice Experts in rice studies carried out during the period 1977 - 1980 and means of the best yields obtained in the separate studies by year.

Year	Fertilizer Usage Kg./ha.			Mean of best yields tonnes/ha.
	N	P_2O_5	K_2O	
1977	35.84	20.16	40.32	6.1
1978	63.00	34.50	0	5.6
1980 1st Qr.	50.10	28.80	33.60)	
1980 3rd Qr.	64.40	28.80	33.60)	
1980 3rd Qr.	76.40	28.80	33.60)	4.6
1980 3rd Qr.	77.40	28.80	33.60)	

The results reported by the Japanese Team of Rice Experts indicate that CICA 8, CICA 9, and Boewani can produce yields of the order of 6 - 7 tonnes per hectare on the clay soils of the Project area. The proximity to which the yields of the future large scale direct-seeded commercial rice cultivation in the Project area approach that order of yield will depend heavily on the provision of adequate irrigation and drainage facilities and on the upgrading of the management of the direct-seeded rice crop.

The results of the rate and timing of nitrogen fertilization study reported by the Japanese Team of Rice Experts are important since those results indicate that the rate and timing of nitrogen fertilization is a critical factor affecting rice yield on the clay soils of the Project area. However, the timing of nitrogen applications of the best treatment cannot be directly transferred for use in a direct-seeded rice crop, but can be transferred for such use with minor modifications.



3. RICE PRODUCTION PRACTICES ON THE BRUMDEC FARM [1]

3.1 Dry-Tillage and Sowing of Ungerminated Seed

When dry-tillage is possible the sequence of operations is as follows:

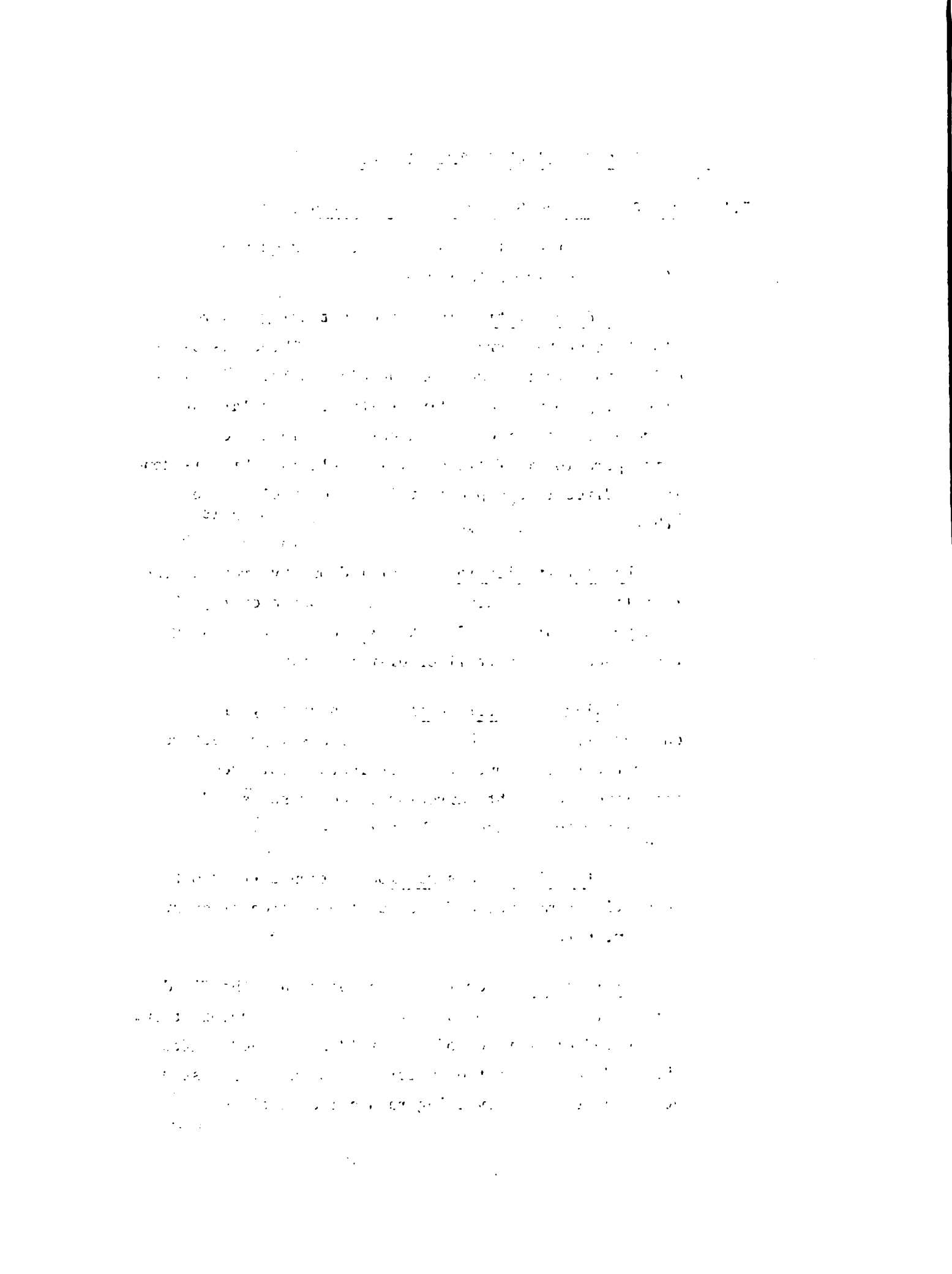
Land preparation is carried out using a Rome plough drawn by a track-type tractor. Three passes are made with this implement on the clay soils, the objective being to produce a fine tilth with the largest aggregates not larger than about 5 cm. in diameter. This operation is followed by land-planing which is done in two directions approximately perpendicular to each other.

Basal fertilization is carried out by broadcasting fertilizer at the rate of 30.1 kg. N per hectare, 60.2 kg. P_2O_5 per hectare, and 30.1 kg. K_2O per hectare using a tractor-operated fertilizer distributor.

Sowing and covering of seed is done by broadcasting dry seed at the rate of 123.3 kg. per hectare using the tractor-operated distributor, followed immediately by light harrowing to cover seeds and fertilizer to a depth of about 1.25 - 2.5 cm.

Contour levee construction is then carried out to provide a maximum difference of elevation of about 6.25 cm. between levees.

Irrigation water is then brought onto the field for a period of 12 hours to facilitate seed germination. At the end of that period the field is drained. After the seed has germinated, water management is adjusted according to the prevailing rainfall conditions.



Weed control is carried out at approximately 3 weeks after sowing. If the field is flooded it is drained prior to spraying. The herbicide used is propanil at the rate of 14.042 litres per hectare.

Nitrogen fertilizer top-dressing is applied at 2 days after weed-control spraying. At this time 52.7 kg. N per hectare are applied and the field is then irrigated.

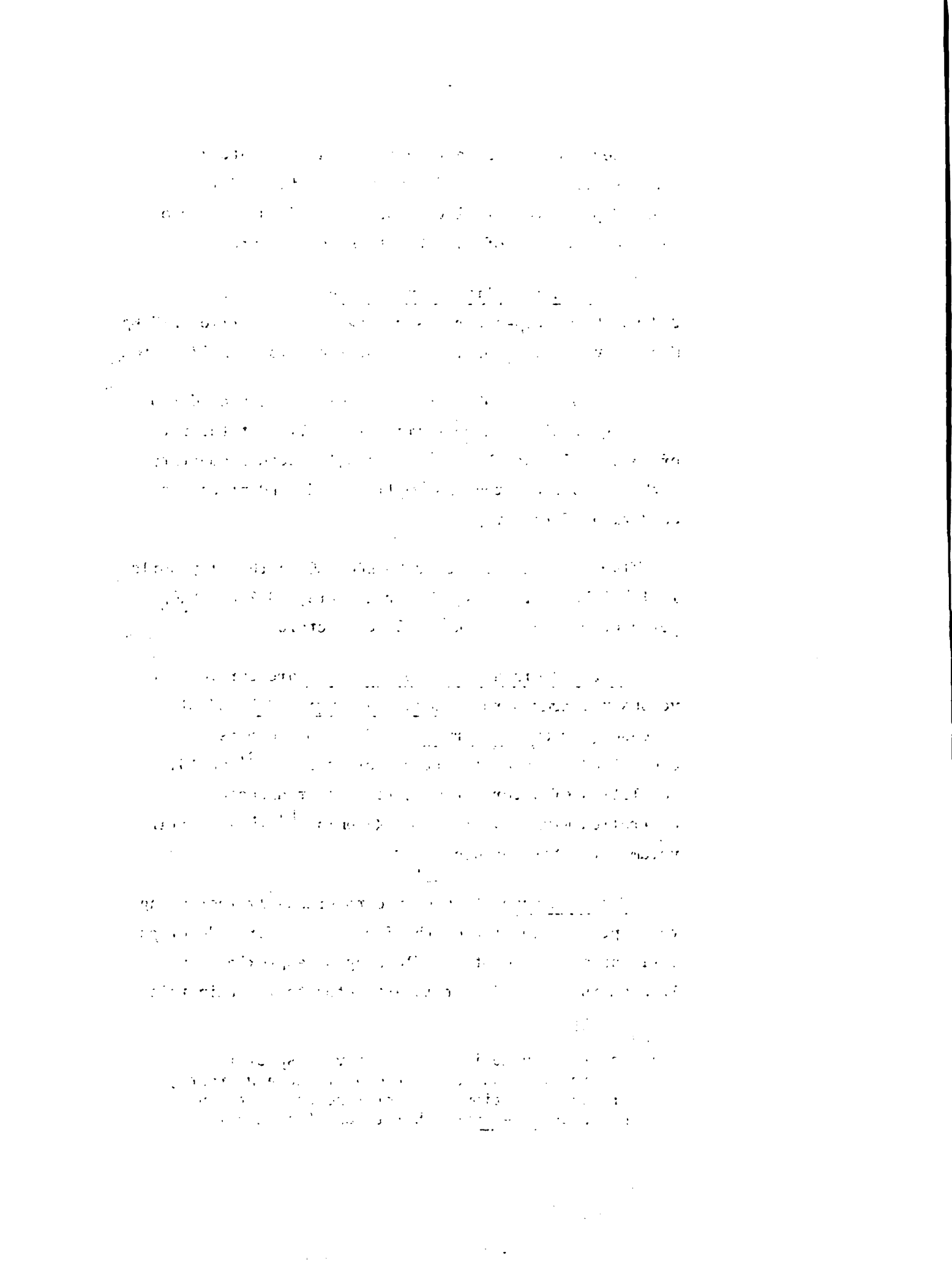
At about 55 - 60 days after sowing the second top-dressing of nitrogen fertilizer is applied at the rate of 26.4 - 52.7 kg. N per hectare. The actual quantity within this range that is applied is dependent on the condition of the crop.

Thus, fertilizer usage by BRUMDEC on the clay soils is 109.2 kg. - 135.5 kg. N per hectare, 60.2 kg. P_2O_5 per hectare, and 30.1 kg. K_2O per hectare.

Pest and disease control measures are carried out versus the army worm (Spodoptera frugiperda) and Blast disease (Pyricularia oryzae). The army worm is controlled by using 1.4 litres of Basudin [(b)] in 134 - 168 litres of water per hectare. Blast disease is controlled with 1.4 litres of Kasumin [(b)] in a similar volume of water per hectare.

Water management is geared to gradually increasing the depth of flooding of the field as the crop develops until an average depth of flooding of approximately 12.5 cm is obtained. It is attempted to maintain this

(b) The trade name is used to provide specific information and does not constitute a warranty, or recommendation, or a preference for the named products vis-a-vis other types of chemicals.



depth of flood through to 110 days after sowing at which time the field is drained to permit drying out of the soil in preparation for the reaping operation.

Reaping is done when the grain moisture is between 18 - 22 per cent. The blower on the combine harvester is adjusted to provide a sufficient airflow to remove most of the chaff since there is no equipment at the mill to scalp and pre-clean the paddy prior to drying. The paddy is transported to the mill by small bulk trailers.

3.2 Wet-tillage and Sowing of Germinated Seed

Wet-tillage is carried out only when dry-tillage cannot be done when excessive rainfall causes saturation or flooding of the field. When wet-tillage is done the the sequence of operations is as follows:

Roto-tilling is carried out in the field which is flooded to a depth of 7.5 - 10 cm. Two passes with the rotavator are made, the second pass being delayed for 5 - 7 days after the first. Immediately after the second roto-tilling is done, the water is drained from the field.

Basal fertilization is carried out by manually broadcasting the same amounts of N, P, and K as stated in 3.1 above.

Sowing of germinated seed is done by manually broadcasting the seed immediately after the basal fertilizer has been applied. The seed-rate used on the basis of dry seed prior to germination is 134.5 kg. per hectare.

Other Cultural Practices under the Wet-tillage System

From immediately after sowing through to reaping all cultural practices are the same as stated for the corresponding period under the Dry-tillage system with the exception that it is not possible to draw-up contour levees mechanically after the soil has been puddled by roto-tilling.

3.3 Drying and Milling of Paddy [8]

Drying of paddy is carried out using batch driers. The mill is equipped with 4 batch driers each of 3 tonnes capacity. The design of these driers permits circulation of the grain during the drying process. Moisture is removed from the grain at the rate of 2 percentage points per pass. Paddy is dried to the required moisture for milling (12 per cent when checked on a Brown-Duvel) and stored for at least 2 days before milled.

Milling of rice is carried out with a one-half tonne capacity mill. Total recovery of rice in the milling process is about 65 per cent., comprised of 45 - 54 per cent head rice and 11 - 20 per cent brokens. Brokens recovery at the high end of the range is commonly obtained when paddy is reaped at moisture contents of less than 18 per cent. Bran recovery is about 8 - 11 per cent and hulls amount to about 22 - 24 per cent.

There is no formal grading system for the basis of purchasing paddy from farmers or for the basis of sale of milled rice. The milled rice is sold to wholesalers, supermarkets, and to private individuals. Packaging is in Polythene bags of 68 kg. net weight.

The bagged rice contains approximately 15 per cent brokens.

4. COSTS OF RICE PRODUCTION ON THE BRUMDEC FARM IN 1980 (UNADJUSTED) (c)

The costs of production stated hereunder are unadjusted costs. Costs incurred in 1979 for the crop reaped in 1980 are upheld and have to be brought forward to the 1980 accounts. Similarly, costs incurred in 1980 for the crop reaped in 1981 are treated in like manner. The figures presented hereunder do not contain those adjustments.

Item of Cost	J$ Cost per hectare
Land preparation	275.64
Making bunds (levees)	8.40
Seeds: purchase, transportation & sowing	121.79
Fertilizers: purchase, transportation, and application	240.23
Plant protection: weed control	263.98
: insect control	108.58
: transporting chemicals	5.39
Irrigating	171.88
Draining fields	6.99
Reaping	49.99
Transporting paddy from field to mill	16.38
Maintenance & repair of drains, canals, & irrigation works & equipment	104.09
Miscellaneous: shooting birds & transporting stores to field	4.52
Total	J$1,377.86

(c) Source: Computer print-out of accumulative expenditure for 1980, monthly mill-production statements, information obtained from discussions with the former Project Manager and Mr. D. Smith, and crop production data supplied by the BRUMDEC office in Santa Cruz.

The Local Rate of Income Tax is 11 per cent.

Licences.

(PROOF OF LETTER FORWARDED ON [illegible] CLAIM [illegible] 1980)

The costs of production should be rounded are
[illegible]ated costs. Costs incurred in life for the p
replaced in 1980 are unpaid dec[illegible] to be brought
forward to the 1982 accounts. Similarly, costs incurred i
in 1990 for the co[illegible] rented in the [illegible] to contain
manner. The figures presented [illegible] do not contain
[illegible] allowances.

	£ per cent	per hectare
Land [illegible] rating		275.61
Farm [illegible] (levies)		8.80
Seeds purchase, transportation, sowing		121 79
Fertilizers purchase, transportation, storage and application		210.23
Plant protection		24.85
Irrigation		106.55
Electricity consumption		3.89
Irrigation		171.85
Transport of goods		6.77
Supply		[illegible]
Transportation costs from field to mill		70.35
Maintenance of equipment & [illegible]		
Contract work		171.09
Miscellaneous ... accounting [illegible]		
Transportation stores to field		4.52
Total		[illegible]

(c) Source: Computer printouts of accumulative expenditure for 1979, monthly mill-production statements, interpretation obtained from [illegible] as with the former Project Manager Mr. D. Gith, and crop production data supplied by the Mission officers in Nakuru Area.

5. PRODUCTION AND INCOME FROM RICE ON THE BRUMDEC FARM IN 1980 (1) (c)

The total hectarage cultivated in 1980 was 222.6 hectares. From that area 532.9 tonnes of paddy were produced. The average yield of paddy was 2.39 tonnes per hectare. The selling price of paddy to the mill was equivalent to J$0.551 per kg. Thus, the gross income from the rice cultivation was approximately J$293,627.90 and income per hectare approximately J$1,319.08. There was a deficit of J$58.78 per hectare.

6. COSTS OF PURCHASING PADDY, DRYING AND MILLING, AND VALUE OF RICE AND BY-PRODUCTS PRODUCED IN 1980 (c)

Item of Cost	J$ Cost
Purchasing paddy: 571.05 tonnes(d)	306,765.64
Operational Costs of receiving, drying, storing, and milling	104,000.71
Repairs and maintenance costs of drying and processing plant	24,941.12
Overhead costs of: purchasing, receiving, storing and milling	27,035.43
security services	41,563.80
Total	J$504,306.70

Item of Value	J$ Value
140.971 tonnes rice @ J$925.68/tonne	130,494.04
159.896 tonnes rice @ J$1,124.04/tonne	179,729.50
2.465 tonnes large brokens @ J$661.20/tonne ...	1,629.86
10.396 tonnes small brokens @ J$220.40/tonne ...	2,291.28
37.186 tonnes bran @ J$264.48/tonne	9,834.95
Paddy purchased but not milled at 31/12/80 87.7 tonnes @ J$537.20/tonne	47,112.44
	J$371,092.07
Profit/(Deficit)	(J$133,214.63)

(d) Includes 38.15 tonnes private paddy.

[illegible]

Milling Recovery

Quantity of paddy milled	483.348	tonnes
Quantity of rice produced	313.728	tonnes
Milling recovery of rice	64.91%	
Quantity of bran produced	37.186	tonnes
Recovery of bran	7.69%	

7. CONSTRAINTS TO EFFECTIVE RICE PRODUCTION IN THE BRUMDEC PROJECT

7.1 Field problems of Rice in the Project area

The writer has examined rice crops grown in the Project area and has observed several constraints which can effectively reduce the yield of rice crops. These constraints are:

7.1.1 Land Levelling

In all rice crops examined the land-levelling of the fields was not effectively done. Ineffective land-levelling contributes to yield reductions by a combination of lowered productivity on the higher areas within a field and by promoting lodging of the crop in the lower areas. Ineffective land-levelling also hampers effective water management and promotes weed infestation, and in general compounds management problems.

7.1.2 Quality of seed

The rice crops examined were of the variety CICA 9. However, in addition to the true-to-type plants of CICA 9 there were several different kinds of off-types and different types of red rices also present in the field.

The frequency of occurence of the red rices and off-types of CICA 9 seemed to be sufficiently high

as to later adversely affect the milling characteristics of the sample. The red rices and most of the off-type plants have grains that are shorter and wider than the grains of CICA 9.

Both types of impurities in the crop are introduced by the seed material.

7.1.3 Rice diseases

Blast disease of rice (Pyricularia oryzae) and Brown Leaf Spot disease (Cochliobolus miyabeanus) = (Helminthosporium oryzae) are prevalent in the Project area. Blast disease was seen on rice plants at around the maximum tillering stage. The percentage of the leaf area that was damaged at that time was about one per cent.

Brown Leaf Spot disease was observed on rice plants that were at or near maturity. Approximately 20 - 25 per cent of the leaf area was damaged. No evidence of infection on the panicles was seen.

7.1.4 Declining paddy yields

The phenomenon of declining yield of paddy with time has been referred to in 2.8 above. The constraints which result in the expression of that phenomenon are yet to be identified.

It is reported to occur also on the BRUMDEC farm where pest and disease control measures are implemented. (1)

Minor element nutrition of the rice plant will require investigation, on the clay soils and the Morass Peat.

7.2 Technological Problems in Rice Cultivation in the BRUMDEC Project

The lack of critical rice crop management data established by the conduct of specific research is seen as the main technological problem in the BRUMDEC Project.

The critical areas of technology for rice cultivation in the Project area are assessed to be:

- Method of land preparation
- Method of rice crop nutrition with respect to N, P, K, and minor elements
- Method of water management
- Method of water management
- Method of pest and disease control.

No specific research effort has been made yet to establish the rice crop requirements of N, P, K, and minor elements for obtaining economic optimum yields on the clay soils and the Morass Peat.

Neither has there been any specific research effort to establish an initial set of norms for the various factors of rice crop management.

The large hectarage to be farmed either by BRUMDEC or by private lessees suggests that technologies employing the use of "ground" equipment such as knapsack sprayers, motorblowers, tractor-operated seed and fertilizer distributors, and manual broadcasting of seed and fertilizer, all need to be examined for economies of scale vis-a-vis the use of agricultural aircraft for the application of seed, fertilizer, and pesticides.

8. INTERIM NORM FOR FERTILIZING DIRECT-SEEDED RICE IN THE BRUMDEC PROJECT

The results of the study by the Japanese Team of Rice Experts reviewed at 2.7 above may be used with modification as an interim norm for fertilizing direct-seeded rice on the clays in the project area.

The rate and timing of N, P, and K should be as follows:

- Basal fertilization before sowing	28.4 kg. N/ha 28.8 kg. P_2O_5/ha 33.6 kg. K_2O/ha
- At 3 weeks after sowing	12 kg. N/ha
- At panicle differentiation	24 kg. N/ha

Those quantities of N, P, and K should be supplied using 307 kg. sulphate of ammonia, 63 kg. triple-super-phosphate, and 56 kg. muriate of potash per hectare.

At current prices those quantities of fertilizers will cost J$128.15 per hectare as compared to J$170.60 and to J$200.04 with former levels of fertilizer use. The saving will be J$42.45 to J$71.89 per hectare.

9. OTHER INTERIM MANAGEMENT PRACTICES FOR RICE CULTIVATION IN THE BRUMDEC PROJECT

Apart from the fertilizer practices dealt with in the foregoing section, the levels of costs reviewed in Section 4 suggest that substantial savings can accrue from:

- the reduction of seed-rate from 123.3 kg. per hectare to 110 kg. per hectare. At the current price of seed the saving amounts to J$8.80 per hectare.

- the substitution of 5.617 litres propanil and 1.404 litres 2, 4-D per hectare in place of 14.042 litres of propanil per hectare for weed control. At current prices saving on material cost will amount to J$61.59 per hectare.

- the substitution of 798 grams active Trichlorfon (840 grams Dipterex 95% S.P. [(b)]) per hectare in place of 1.404 litres Basudin [(b)] per hectare for army worm control. At current prices the saving in material cost will be J$16.39 per hectare.

From the above modifications in fertilizer and other management practices the cost of materials can be reduced by J$129.23 to J$158.67 per hectare.

The utilization of labour on the BRUMDEC farm [(1)] has been as follows:

- for sowing: 1.01 hectare per man-day;
- for each application of fertilizer: 1.01 hectare per man-day;
- for spraying: 0.4047 hectare per man-day.

Those outputs per man-day are all low. The following new standards of output per man-day can be achieved:

- for sowing and for each application of fertilizer: 3.2 hectares per man-day;
- for spraying: 5 hectares per man-day using motoblowers.

(b) See footnote (b) of sub-section 3.1

Land preparation should entail either a single wet-harrowing followed by puddling and underwater-levelling or double dry-harrowing followed by puddling and under-water-levelling. The initial harrowing should be done with a Rome offset harrow [(b)] (about 3.05 metres width) drawn by a D6 Caterpillar tractor. [(b)] Equipment for underwater levelling can be readily improvised.

For adequately effective water management average depth of flooding should not exceed 10 cm. with a range of depth from 5cm. to 15 cm. To achieve such control the maximum difference in levels between the irrigation and drainage ends of a field should not exceed 10 cm. If a difference of level greater than 10 cm. should exist in a field, then that field should be sub-divided by one or more levees.

It may be necessary to acidify the river-water used as the carrier for pesticide and fungicide sprays to about ph 6.0. Several pesticides and fungicides are less effective when mixed with alkaline water.

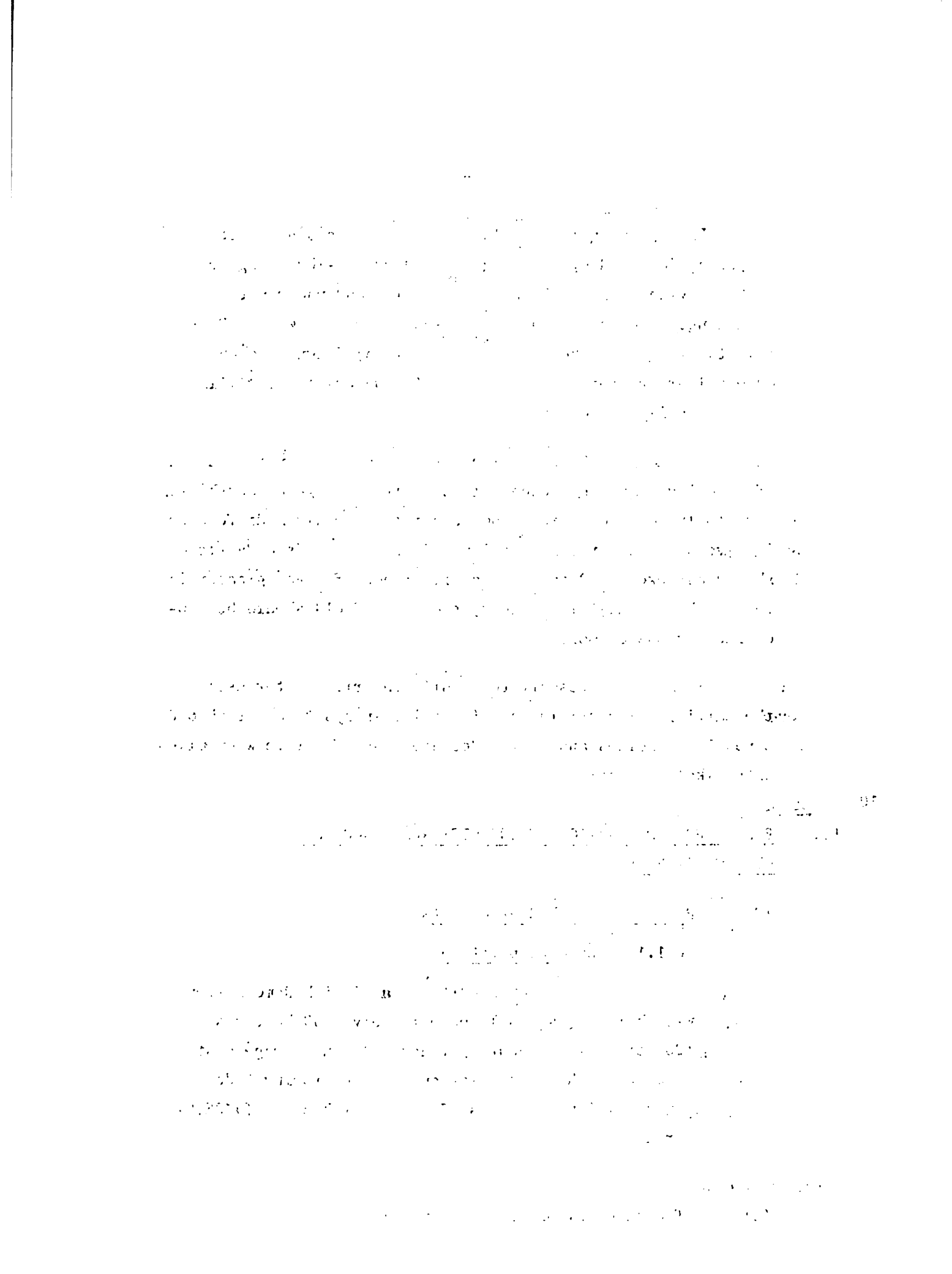
10. BUDGET FOR CULTIVATION OF 405 HECTARES (1000 ACRES) OF RICE AT BRUMDEC

10.1 Rationale for budgeted costs

10.1.1 Land Preparation

Under wet conditions a D6 with Rome harrow will harrow (1st cut) approximately 8.09 hectares (20 acres) in 10 hours per day. At an average cost of J$50 per hour, the 1st cut Rome harrowing under wet conditions will cost J$61.80 per hectare (J$25.01 per acre).

(b) See footnote (b) of sub-section 3.1



Under dry conditions a D6 with Rome harrow will harrow (1st cut) approximately 10.1 hectares (25 acres) in 10 hours per day. The cost of 1st cut Rome harrowing under dry conditions will be J$47.62 per hectare (J$19.27 per acre). For the 2nd Rome harrowing under dry conditions output in 10 hours is expected to be 12.1 hectares (30 acres). The cost of 2nd cut Rome harrowing under dry conditions will be J$41.32 per hectare (J$16.72 per acre).

If 1st cut Rome harrowing can begin on 24th June, 1981, it will have to be done under wet conditions since the rains are now beginning to taper off. All areas projected to be put under rice this season will be drained as best as possible by drawing out shallow surface channels in the fields to remove surface water, so that, hopefully by July 15, 1981, dry harrowing (which is a more productive use of tractor-operating time) can be done.

It is proposed that two (2) D6 Caterpillar tractors with Rome Harrow to be rented to do the initial harrowing. Muir-Hill (115 HP) or IH (145 HP) 4WD Tractors outfitted with high-flotation tyres can be used for the puddling operations. The scale of the proposed operations dictates that high horsepower machines be used in order to complete the land preparation operations quickly. Levelling will be done in flooded fields. For that operation an improvisation is necessary -- D6 Caterpillar pulling an angled 6.1 - 7.6 m. (20 - 25ft.) telegraph pole. That method of underwater-levelling is known to work well even on heavy clays.

During the period June 24 - July 10, only wet-tillage operations should be practiced. Two (2)

D6 Caterpillars are expected to 1st cut Rome harrow 275 hectares (679 acres) during that 17-day period. Starting July 15, the remaining 130 hectares (321 acres) will be dry-harrowed.

10.1.2 Summary of Land Preparation operations

Area	Operations
275 hectares (679 acres):	Wet-harrowing (single)
:	Flooding and Puddling
:	Underwater levelling
130 hectares (321 acres):	Dry-harrowing (double)
:	Flooding and Puddling
:	Underwater levelling

Expected production for the puddling operation are:

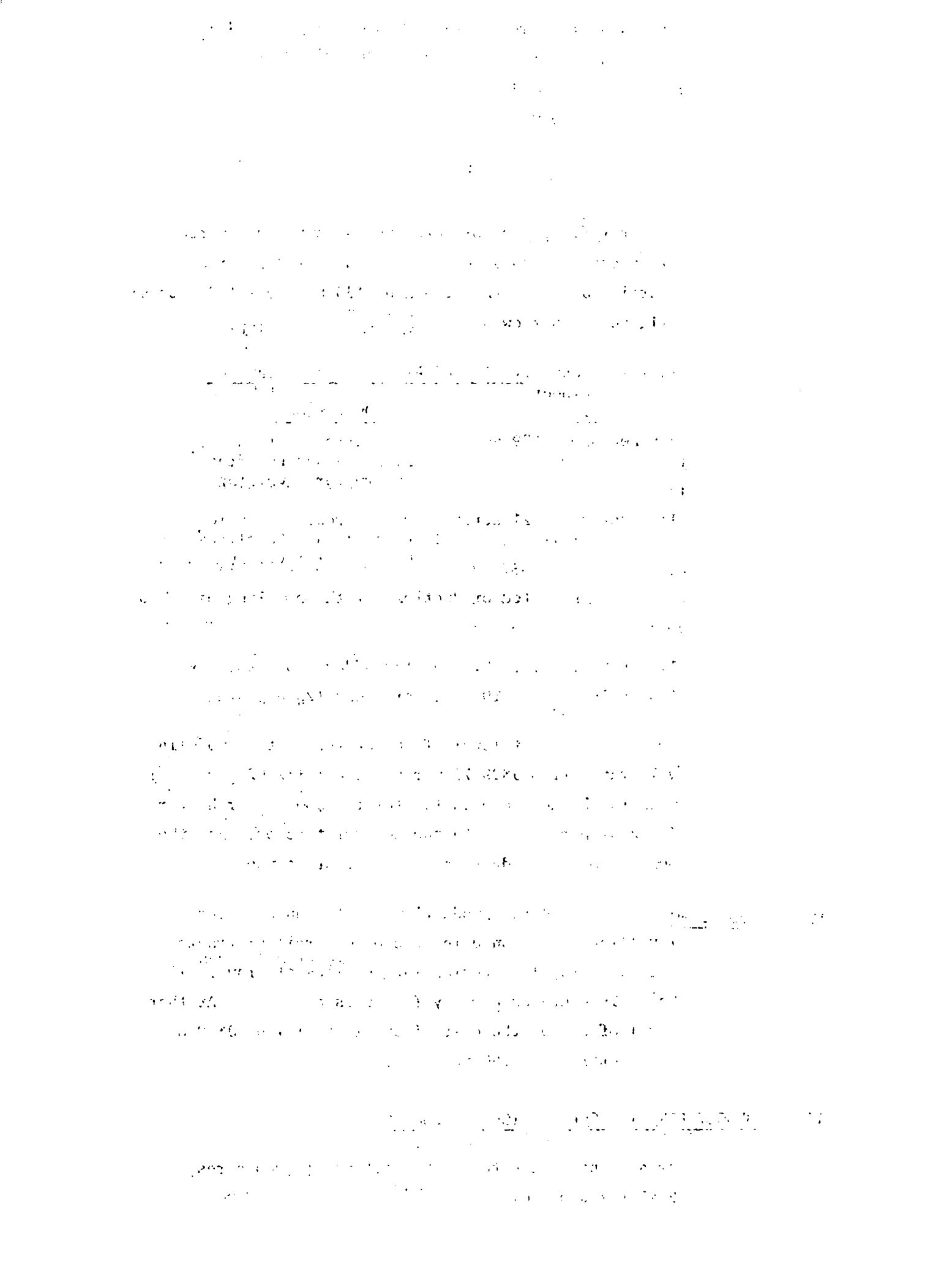
115 HP Muir-Hill: 8.09 hectares/day (20 acres/day)
145 HP IH : 10.1 hectares/day (25 acres/day)

At that level of output the cost of puddling will range from J$29.70 per hectare (J$12.02 per acre) with the higher-powered tractor to J$30.90 per hectare (J$12.51 per acre) with the smaller tractor. For the purpose of the budget the higher cost is used.

Expected production for the under-water levelling operation using the D6 Caterpillar tractor (allowing for 10% overlapping in lines of travel) will be 16.19 hectares per day (40 acres per day). At that level of output the cost of puddling will be J$30.88 per hectare (J$12.50 per acre).

11. BUDGET FOR RICE CULTIVATION AT BRUMDEC

Area to be cultivated: 405 hectares (1,000 acres)
Soil texture: Clay

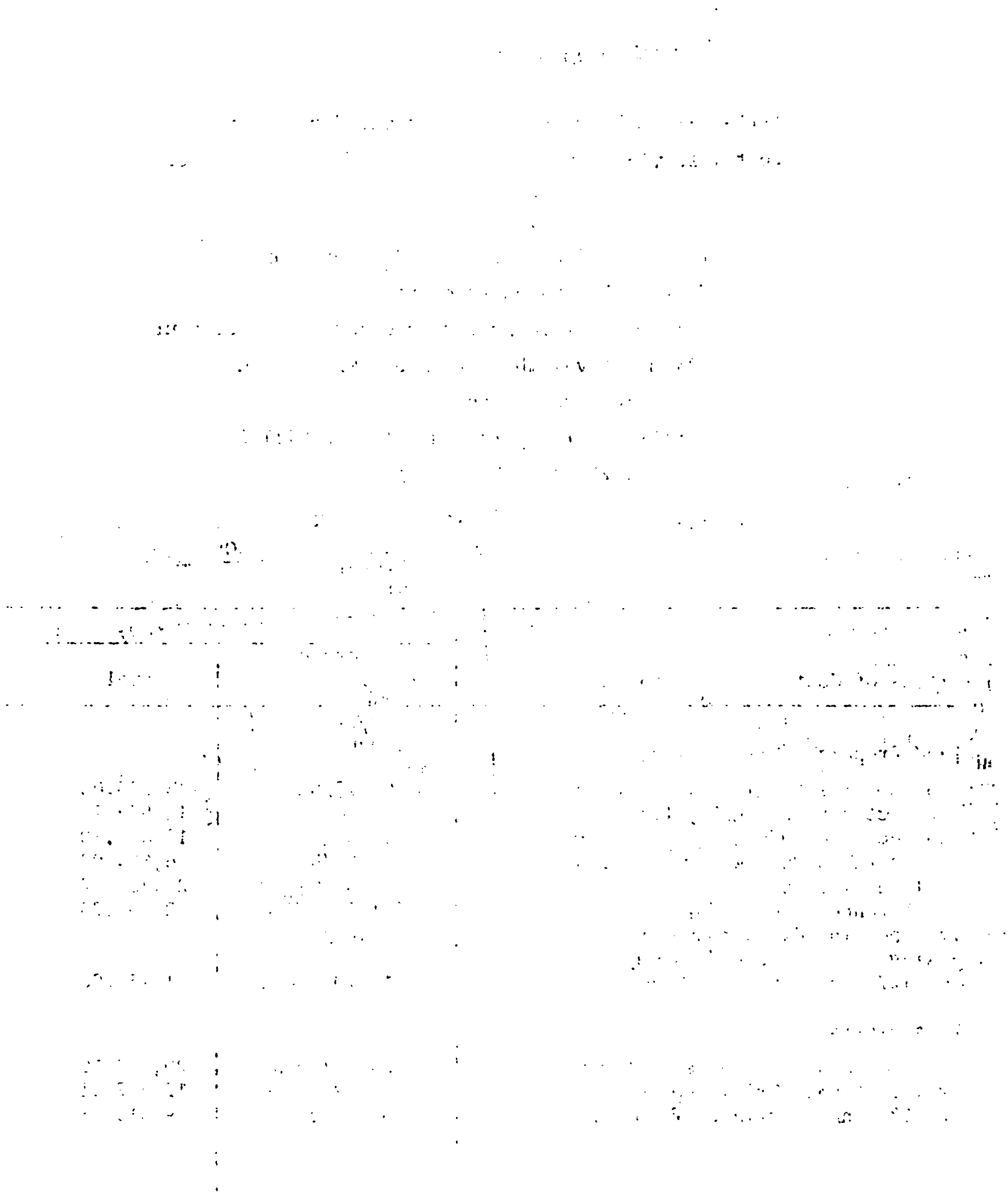


Machinery to be rented, the estimated rates of rental services are:

D6 Caterpillar @ J$45 - J$55 per hour
4 WD Rubber-tyred tractors
Muir-Hill or IH preferred @ J$25 - 30 per hour
(If none available, then use MF or Ford @ J$18 - 22 per hour).
Trucks to transport paddy to ADC Mill @ J$2.25 per 100 lb. bag.

Labourers rate of pay: J$13.70 per day.

Items of Cost	COST (JD) per hectare or unit	COST (JD) Total
Land Preparation:		
275 hectares Single Wet-harrowing	61.80/ha	16,995.00
130 hectares Double Dry-harrowing	88.94/ha	11,562.20
405 hectares Puddling	30.90/ha	12,514.50
405 hectares Underwater-levelling	30.88/ha	6,804.00
Building levees	16.80/ha	29,464.92
44.55 tonnes seed paddy	661.39/tonne	2,004.75
Transporting 44.55 tonnes seed paddy	45.00/tonne	
Sowing seed @ 3.2 ha/man-day: 127 man-days	13.70/man-day	1,739.90
Fertilizers:		
124.335 tonnes Sulphate of Ammonia	234.44/tonne	29,149.10
25.515 tonnes Triplesuperphosphate	503.32/tonne	12,842.21
22.68 tonnes Muriate of Potash	436.99/tonne	9,910.93



Items of Cost	COST (JD) per hectare or unit	COST (JD) Total
Manual broadcasting of fertilizers: 3 applications: 3.2 ha/man-day		
381 man-days	13.70/man-day	5,219.70
Transporting fertilizer: 172.53 tonnes	58.00/tonne	10,006.74
Weed control chemicals		
570 litres 2, 4-D	4.32/litre	2,462.40
2,275 litres Propanil	8.03/litre	18,268.25
Spraying: 81 man-days	13.70/man-day	1,109.70
Insect control chemical:		
340.2 kg. Dipterex 95% SP	20.12/kg	6,844.82
Spraying: 81 man-days	13.70/man-day	1,109.70
Transporting chemicals	5.39/ha.	2,182.95
Irrigating and draining fields	178.87/ha.	72,442.35
Reaping	98.31/ha.	39,815.55
Transporting paddy to mill:		
1906.4 tonnes	45.00/tonne	85,788.00
Maintenance and repair of drains, canals and irrigation works and equipment	104.09/ha.	42,156.45
Miscellaneous: shooting birds and transporting stores to field	5.00/ha.	2,025.00
		434,925.52

Budgeted cost of production: per hectare: J$1,073.89

: per acre : J$ 434.60

Budgeted Income:

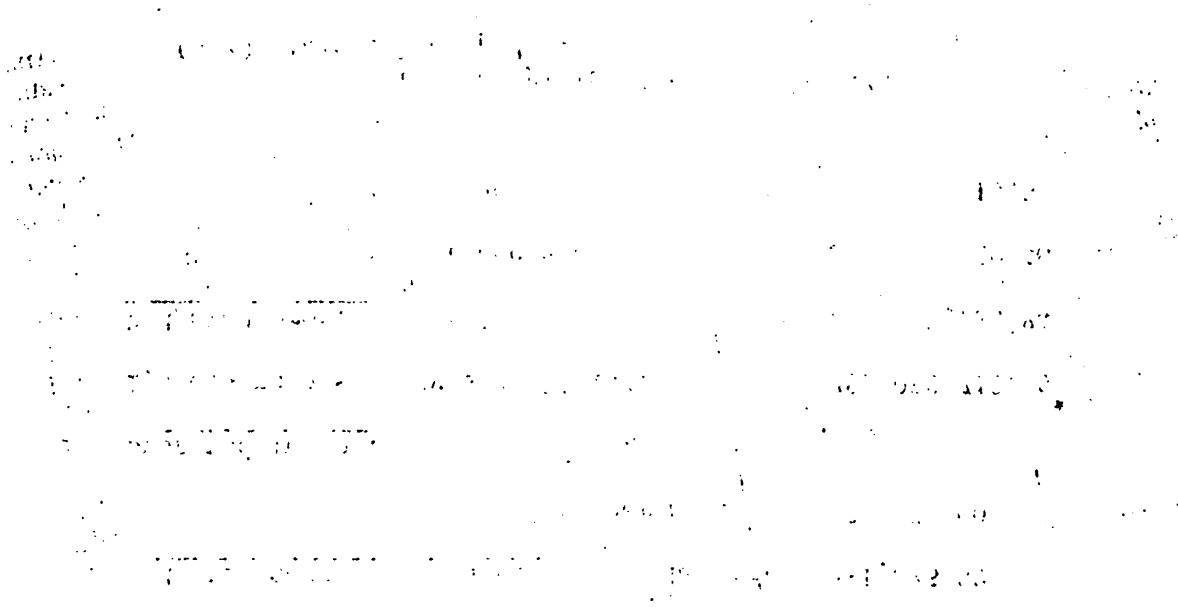
1,906.4 tonnes paddy @ J$551.15/tonne : J$1,050,712.36*

Budgeted profit: Total : J$ 615,786.84

: per hectare : J$ 1,520.46

: per acre : J$ 615.32

* Based on an estimated yield of 4.707 tonnes/ha (4,200 lb/acre) of paddy.



12. REFERENCES

1. SMITH, Derrick. Personal communication.

2. SUAH, J.R.R. 1979. Rice Research. Ministry of Agriculture, Jamaica. 2p.

3. KOBAYASHI, Hironori. 1978. Quarterly report X-1 on technical co-operation to rice expansion project in Jamaica. April 1 to June 30, 1978. Ministry of Agriculture. 6p.

4. KOBAYASHI, Hironori. 1978. Quarterly report XI-1 on technical co-operation to rice expansion project in Jamaica, July 1 to September 30, 1978. Ministry of Agriculture, Jamaica. 6p.

5. NAGAI, Kotaro. 1979. Report on the co-operated rice expansion project in Jamaica. Ministry of Agriculture, Jamaica. 41p.

6. KOBAYASHI, Hironori. 1980. Quarterly report XVII on technical co-operation to rice expansion project in Jamaica, January 1 to March 31, 1980. Ministry of Agriculture, Jamaica. 14p.

7. KOBAYASHI, Hironori, 1980. Quarterly report XIX on technical co-operation to rice expansion project in Jamaica, July 1 to September 30, 1980. Ministry of Agriculture, Jamaica. 13p.

8. CROSS, Derrick. Personal communication.

AGRICULTURE IN JAMAICA

Collection of papers of the Office of IICA in Jamaica

1977 - 1978

No. I - 1 Fritz Andrew Sibbles, "Basic Agricultural Information on Jamaica Internal Document of Work", January 1977

No. I - 2 Yvonne Lake, "Agricultural Planning in Jamaica", June 1977

No. I - 3 Aston S. Wood, Ph.D., "Agricultural Education in Jamaica", September - October 1977

No. I - 4 Uli Locher, "The Marketing of Agricultural Produce in Jamaica", November 1977

No. I - 5 G. Barker, A. Wahab, L. A. Bell, "Agricultural Research in Jamaica", November 1977

No. I - 6 Irving Johnson, Marie Strachan, Joseph Johnson, "Land Settlement in Jamaica", December 1977

No. I - 7 Government of Jamaica, "Agricultural Government Policy Papers", February 1978

No. I - 8 Jose Emilio Araujo, "The Communal Enterprise", February 1980

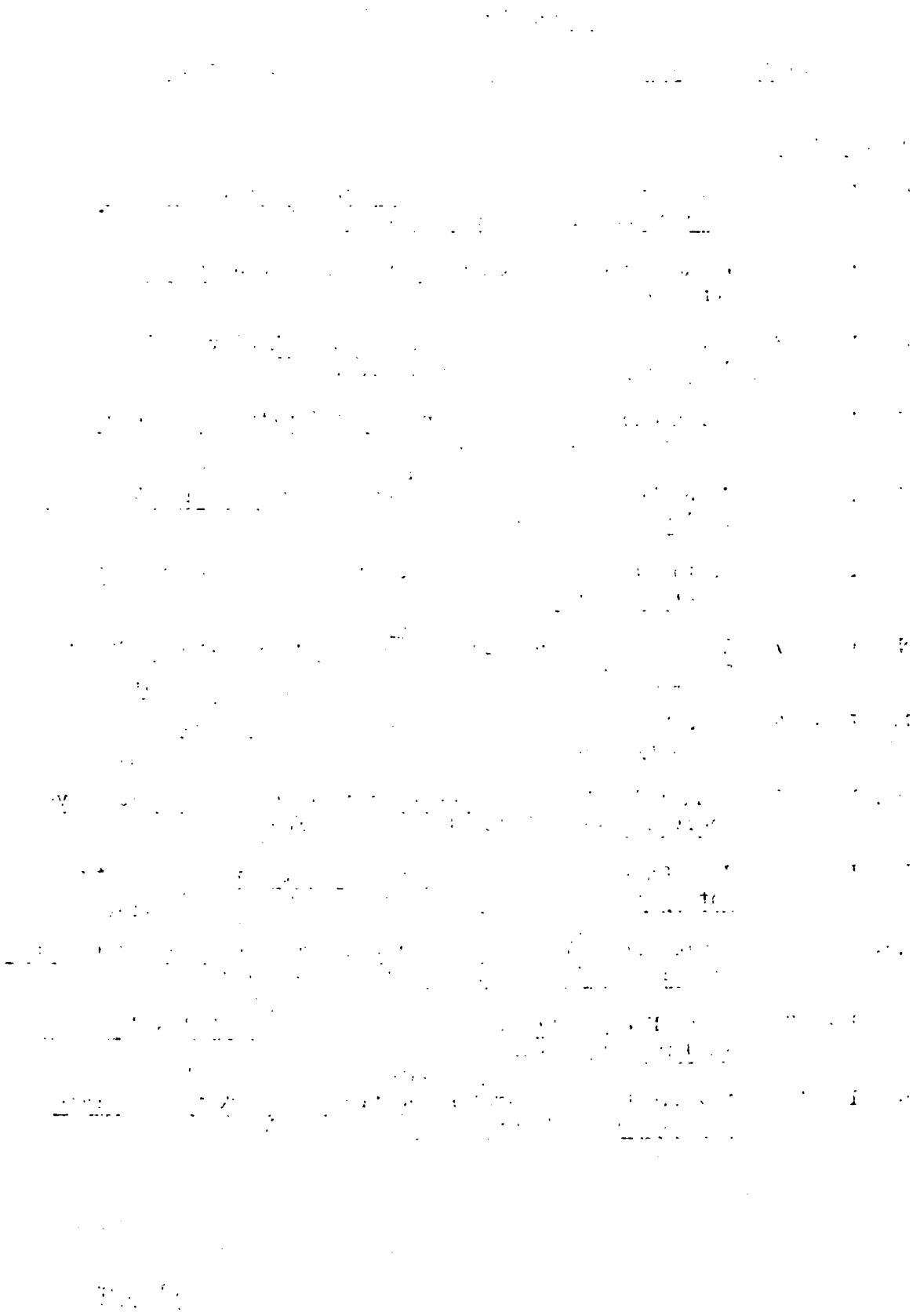
No. I - 9 IICA and MOAJ, "Hillside Farming Technology - Intensive Short Course", Vols. I and II, March 1978

No. I - 10 Jose Emilio Araujo, "The Theory Behind the Community Enterprise - Seminar in Jamaica", March 1978

No. I - 11 Marie Strachan, "A National Programme for the Development of Hillside Farming in Jamaica", April 1978

No. I - 12 D. D. Henry, "Brief Overall Diagnosis of Hillside Farming in Jamaica", April 1978

No. I - 13 Neville Farquharson, "Production and Marketing of Yams in Allsides and Christiana", May 1978



No. I - 14 R. C. E. McDonald, A. H. Wahab, "Fertility Assessment of Newly Terraced Hillside Soils Using the Microplot Technique - the Allsides Case Study", 1978

No. I - 15 IICA - IDB, "Course in Preparation and Evaluation of Agricultural Projects", Vols. I and II, November 1977

No. I - 16 Neville Farquaharson, "Production and Marketing of Dasheen in Allsides and Christiana", June 1978

1978 - 1979

No. II - 1 O. Arboleda-Sepulveda (IICA-CIDIA), "Agricultural Documentation and Information Network in Jamaica", September 1978

No. II - 2 Victor Quiroga, "National Agricultural Information System", (NAIS-Jamaica) Project Profile, September 1978

No. II - 3 Joseph Johnson, "A Review on Land Reform in Jamaica for the Period 1972 - 1978", September 1978

No. II - 4 Neville Farquharson, "ABC of Vegetable Farming", A Draft High School Textbook, Vols. I, II, III and IV, February 1979

No. II - 5 Jerry La Gra, "Elements of an Agricultural Marketing Strategy for Jamaica", March 1979

No. II - 6 D. D. Henry, I. E. Johnson, "Agricultural Extension Service in Jamaica", March 1979

1979 - 1980

No. III - 1 H. R. Stennett, "Watersheds of Jamaica and Considerations for an Ordinal Scale of their Development", July 1979

No. III - 2 IICA-MAJ, "Hillside Farming in Jamaica", A Training Seminar, December 1978

No. III - 3 A. L. Wright, A. H. Wahab, H. Murray, "Performance of Six Varieties of Red Peas (Phaseolus vulgaris L.) on a Newly Terraced Ultisol in Jamaica", September 1979

No. III - 4 IICA/Jamaica Staff, "Agro-Socio-Economic Sample Survey of Allsides - Trelawny, Jamaica", September 1979

No. III - 5 IICA-MOAJ, "An Approach to Agricultural Settlement of Hilly Lands", October 1979

No. III - 6 IICA-MOAJ, "Tree Crops of Economic Importance to Hillside Farms in Jamaica", October 1979

No. III - 7 Canute McLean, "Production and Marketing of Peanuts", November 1979

1980

No. IV - 1 Joseph Johnson, "Production and Marketing of Red Peas in the Hilly Areas of Jamaica", January 1980

No. IV - 2 Lyn Snuffer, "Rural Women: An Annotated Caribbean Bibliography with special reference to Jamaica", January 1980

No. IV - 3 Vincent Campbell, Abdul Wahab, Howard Murray, "Response of Peanut (Arachis hypogaea L.) on a Newly Terraced Ultisol in Jamaica", January 1980

No. IV - 4 P. Aitken, A. Wahab, I. Johnson, A. Sahni, "Agro-Socio-Economic Survey - Pilot Hillside Agricultural Project 'PHILAGRIP' Southern Trelawny", February 1980

No. IV - 5 Glenys H. Barker, "Bibliography of Literature relating to Research and Development in the Agricultural Sector of Jamaica 1959 - 1979", March 1980

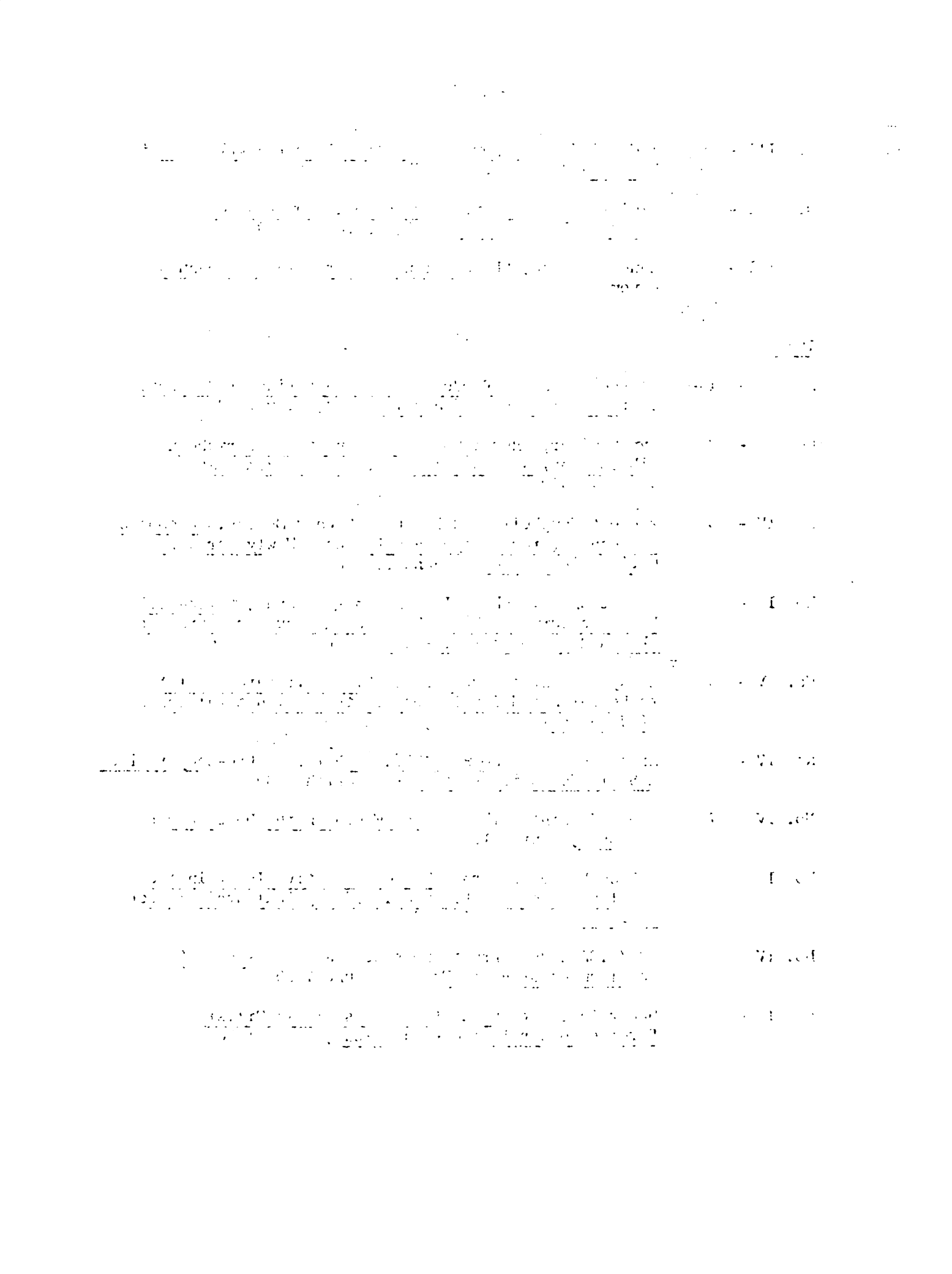
No. IV - 6 Milton R. Wedderburn, "Allsides Farmers' Pre-Cooperative A Socio-Economic Assessment", March 1980

No. IV - 7 Adele J. Wint, "The Role of Women in the Development Process", April 1980

No. IV - 8 Milton R. Wedderburn, "The Co-operative Input in the Development of the Pilot Hillside Agricultural Project (PHILAGRIP)", April 1980

No. IV - 9 MOJ/IICA/CARDI, Fruit Trees Seminar - "Research & Development of Fruit Trees", June 1980

No. IV - 10 Henry Lancelot, "Traditional Systems in Hillside Farming, Upper Trelawny, Jamaica", June 1980



No. IV - 11 IICA/Jamaica, "Pilot Hillside Agricultural Project", (PHILAGRIP), Project Document. Vols. I, II and III, June 1980

No. IV - 12 A. Wahab, I. Johnson, P. Aitken, H. Murray and H. Stennett, "Highlights of the Pilot Hillside Agricultural Project at Allsides", July 1980

No. IV - 13 I. Johnson, A. Wahab, P. Aitken, H. Payne, "Benchmark for a Project Profile for Developing a Peanut Industry in Jamaica", July 1980

No. IV - 14 P. Aitken, A. Wahab, I. Johnson, "The Allsides Post Peasant", August 1980

No. IV - 15 Norma Munguia, Percy Aitken, Abdul Wahab, Irving Johnson, "Salt Extraction by Solar Energy", A Mini-project, September 1980

No. IV - 16 Abdul H. Wahab, Percy Aitken-Soux, Irving E. Johnson and Howard Murray, "The Allsides Project in Jamaica - Developmental Potentials of Hillside Agriculture", September 1980

No. IV - 17 P. Aitken, A. Wahab, I. Johnson, A. Sahney and N. Munguia, "Rural Women Survey", Vols. I, II and III, October 1980

No. IV - 18 P. Aitken, I. E. Johnson, A. Wahab, "Assessment of Employment Among Small Hillside Farmers of Jamaica", November 1980

No. IV - 19 IICA/Jamaica "Pilot Hillside Agricultural Project", (PHILAGRIP), Final Project Document. October 1980.

No. IV - 20 P. Aitken, A. Wahab, I. E. Johnson, Bo-Myeong Woo, "IICA Evaluation of the First Phase FSB Allsides Project", (Internal Document of Work), November 1980

No. IV - 21 MINAG/IICA/CARDI - "Seminar on Multiple Cropping", December 1980

1981

No. V - 1 N. Munguia, P. Aitken, A. Wahab, I. Johnson, "Smoke Curing of Fish (as a household industry in Rural Jamaica)", January 1981

No. V - 2 P. Aitken, A. Wahab, I. Johnson, "Under-employment - It's Relation to the Agricultural Sector and Considerations for its Management", January 1981

No. V - 3 D. D. Henry, J. R. Gayle, "The Culture of Grafted Pimento (as spice crop for Allsides, Jamaica)", January 1981

No. V - 4 Abdul H. Wahab, Noel Singh, "Agricultural Research in Jamaica", February 1981

No. V - 5 P. Aitken-Soux, A. H. Wahab, I. E. Johnson, "Country Level Action Plan (CLAP)", May 1981

No. V - 6 P. Aitken-Soux, A. H. Wahab, I. E. Johnson, "Overview of Agricultural Development in Jamaica", May 1981

No. V - 7 Samuel Thompson, I. E. Johnson, P. Aitken-Soux, Abdul Wahab, "The Land Development & Utilization Act 1966", July 1981

No. V - 8 Abdul Wahab, Percy Aitken-Soux, Irving Johnson, Bo-Myeong Woo, Howard Murray, Joseph Dehaney, "The Experiences of Jamaica in the Management of Agricultural Production on Hillsides", July 1981

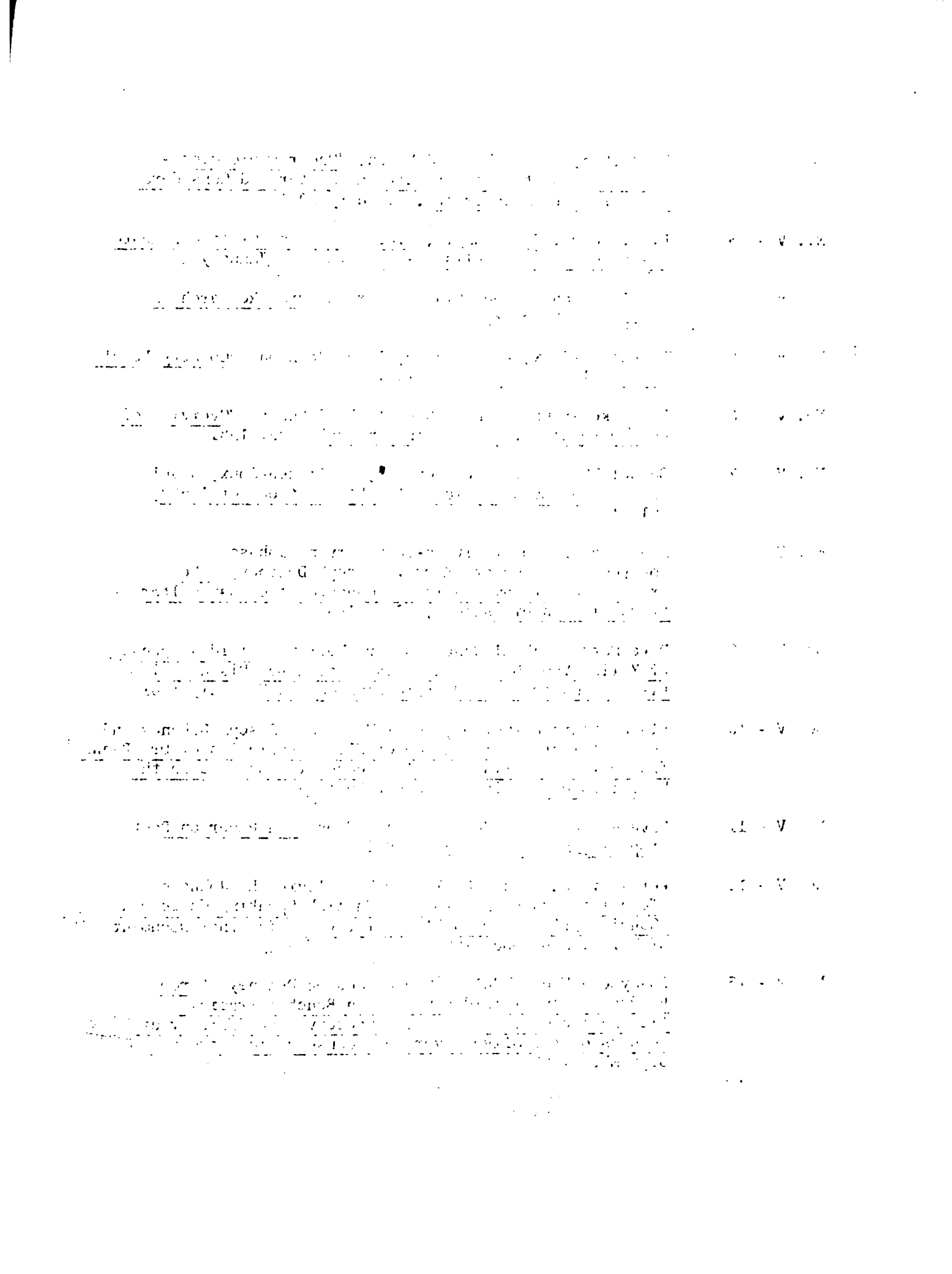
No. V - 9 Dave Hutton, Abdul Wahab, Howard Murray, "Yield Response of Yellow Yam (Dioscorea Cayenensis) After Disinfesting Planting Material of Pratylenchus Coffeae", July 1981

No. V - 10 Elaine Montague-Gordon, Abdul H. Wahab, Joseph Dehaney and Audrey Wright, "Performance of Eleven Varieties of Dry Beans (Phaseolus vulgaris) Over Two Successive Seasons on the Hillsides of Jamaica", August 1981

No. V - 11 Dave G. Hutton, Abdul H. Wahab, "Position Paper on Root Crops in Jamaica", August 1981

No. V - 12 Percy Aitken-Soux, Abdul H. Wahab, Irving E. Johnson, "Technical Assistance for the English Speaking Caribbean (Considerations for an IICA Strategy)" (Internal Document of Work), September 1981

No. V - 13 Bo-Myeong Woo, Abdul H. Wahab, Joseph Dehaney, "Crop Production on Hillsides using non-Bench Terracing Alternative Measures for Soil Conservation (first year's results of the Olive River Soil Conservation studies)", September 1981



No. V - 14 Abdul H. Wahab, Percy Aitken-Soux, Irving E. Johnson, Bo-Myeong Woo, Howard Murray and Joseph Dehaney, "Agricultural Production on Hillsides - the Allsides Project Case Study", September 1981

No. V - 15 D. G. Hutton, A. H. Wahab and J. Dehaney, "Investigating Critical Levels of Dry Rotting of Yellow Yam (Dioscorea Cayenensis) Planting Material, the Benefits of Disinfesting the Heads of Pratylenchus Coffeae and of After-Planting Nematicide Treatments", September 1981

No. V - 16 D. G. Hutton, A. H. Wahab, H. Murray and J. Dehaney, "Critical Levels of Dry Rotting of Yellow Yam (Dioscorea Cayenensis) Planting Material and Yield Responses After Disinfesting Heads of Pratylenchus Coffeae and After Post-Plant Nematicide Applications", September 1981

No. V - 17 E. Ayer and J. Reyes, "Seminar on Mediterranean Fruit Fly", September 30, 1981

No. V - 18 Bo-Myeong Woo, "Erosion Control Works in Korea", October 1981

No. V - 19 Irving E. Johnson and Percy Aitken-Soux, "Country Level Action Plan (CLAP)" (Third Revision - Internal Document of Work), October 1981

No. V - 20 Humberto Pizarro, "Programme of Work to Establish Guidelines for the Effective Administration, Operation and Maintenance of the Irrigation and Drainage District in the BRUMDEC Project" November 1981

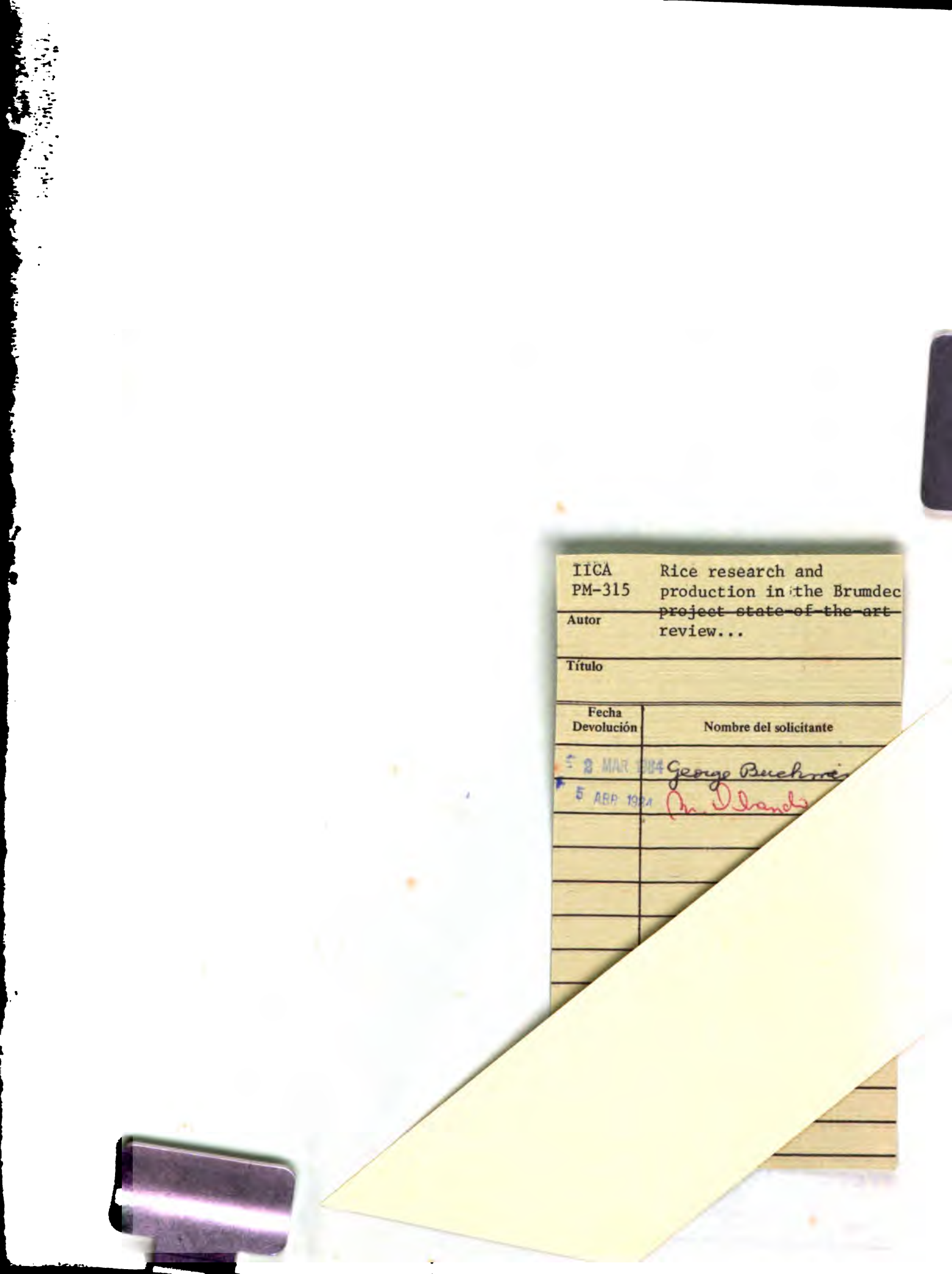
No. V - 21 Humberto Pizarro, "The Operation of the Drainage System in the Black River Upper Morass Project", November 1981

No. V - 22 Humberto Pizarro, "Recommendations for Land Use and Irrigation Needs in the BRUMDEC Project", November 1981

No. V - 23 Humberto Pizarro, "Organization, Operations and Maintenance of the Irrigation System in the BRUMDEC Project", November 1981

No. V - 24 Humberto Pizarro, "Basic Information for Planning Water Management in the BRUMDEC Project", November 1981

FECHA DE DEVOLUCION			
F 2 [illegible] 1984			
5 ABR 1984			



IICA
PM-315

Rice research and production in the Brumdec ~~project state-of-the-art~~ review...

Autor

Título

Fecha Devolución	Nombre del solicitante
2 MAR 1984	George Buchanan
5 ABR 1984	M. Islands