SUPPLEMENTARY REPORT ON THE APPLIED RESEARCH WORK CARRIED OUT WITH RED BEANS AT BRUMDEC BY THE GRAIN PRODUCTION SPECIALIST

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by

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SUPPLEMENTARY REPORT ON THE APPLIED RESEARCH WORK CARRIED OUT WITH RED BEANS AT BRUMDEC BY THE IICA GRAIN PRODUCTION SPECIALIST (1)

1. INTRODUCTION

During January/February 1982 five (5) experiments were started with red bean, two (2) on Four Paths Clay and three (3) on Morass Peat. On each soil type a basic fertilizer experiment and a relevance of production factors experiment were carried out. Additionally, on the Morass Peat soil a variety trial was done.

2. MATERIALS AND METHODS

2.1 Basic fertilizer trials with red bean

The objectives of these trials were to compare the yield responses due to four different fertilizers on Four Paths Clay and on Morass Peat, and to identify any significant interactions between fertilizers.

The treatments tested were combinations of four factors each at two levels:-

Fertilizer	Levels	Rate on Clay Soil	Levels	Rate on Peat Soil
N	N_0	30 kg/ha	N_0	20 kg/ha
	N_1	50 kg/ha	N	40 kg/ha
P_2O_5	P_0	50 kg/ha	P_0	40 kg/ha
	P_1	100 kg/ha	P_1	80 kg/ha
K_2O	K_0	50 kg/ha	K_0	40 kg/ha
	K_1	100 kg/ha	K_1	80 kg/ha
Zn	Zn_0	0 kg/ha	-	-
	Zn_1	0.25 kg/ha	-	-
Cu			Cu_0	0.25 kg/ha
			Cu_1	0.50 kg/ha

(1) This report was prepared by the IICA Rice Production Specialist, Mr. Vivian Chin, on behalf of the IICA Grain Production Specialist, Mr. Claude Grand-Pierre whose contract had expired prior to the completion of the experiments.

The experimental design was a 2^4 factorial with the four-factor interaction confounded with blocks in an incomplete block design. Plant population density was approximately 200,000 plants per hectare. All nitrogen, phosphate, and potash fertilizers were applied before sowing. On the clay soil, zinc chelate was mixed with Benlate and malathion and sprayed on to the plants at 23 days after sowing. On the peat soil Copper sulphate was mixed with Benlate and Malathion and sprayed on to the plants at 14 days after sowing.

Pest and disease control measures were carried out as and when necessary. Weeding was done manually at 14 days after sowing on the clay soil, and at 11 days after sowing on the Morass Peat.

2.2 Relevance of production factors experiment with red beans

The objectives of these trials was to identify the critical factors in red bean production on the two soil types. The treatments tested were:-

Treatment Number	Details of treatment	
	Clay Soil	Peat Soil
1	BPP	BPP
2	BPP minus N	BPP minus N
3	BPP minus P	BPP minus P
4	BPP minus K	BPP minus K
5	BPP minus Insecticide	BPP minus Insecticide
6	BPP minus Fungicide	BPP minus Fungicide
7	BPP at lower plant density	BPP at lower plant density
8	Untreated (variety only)	Untreated (variety only)
9	-	BPP plus Manganese

In each case the experimental design used was a randomized complete block, with four replications on the clay site and three replications on the Morass Peat site.

The BPP (basic production package) on the clay soil was composed of: Improved variety (Miss Kelly) + 40 kg N/ha + 80 kg.

P_2O_5/ha + 80 kg K_2O/ha + density of 200,000 plants/ha+ Basudin at 2.5 kg/ha + Kocide at 2.5 kg/ha. The reduced plant population of treatment number 7 on both sites was 150,000 plants per hectare. On the Morass Peat the BPP differed from that used on the clay only in the amount of nitrogen applied-- 20 kg.N/ha. For treatment 9 on the peat site manganese was used at the rate of 0.5 kg.Mn/ha.

2.3 Variety trial with red bean

The objective of this experiment was to compare the performance of commercial and experimental varieties of red bean on the Morass Peat soil. Three varieties of red bean were tested for grain production. The varieties were:-

Miss Kelly
Line 23 from CIAT
Line 24 from CIAT

All varieties were fertilized at the rate of zero nitrogen, 100 kg P_2O_5/ha, 100 kg K_2O/ha. Planting density was 200,000 plants per hectare. Pest and disease control were carried out as and when necessary. The experimental design was a randomized complete block with three replications.

3. RESULTS OF EXPERIMENTS WITH RED BEAN

3.1 Basic fertilizer trial on Four Paths Clay

The mean yields of the treatments are given in Appendix 1. The nitrogen x zinc interaction effect was found to be significant at the 5% level of probability. No other interactions or main effect was found to be significant. The value of the NxZn effect was - 559±220 kg/ha. The mean response to zinc, over all levels of phosphate and potash when nitrogen was applied at 30 kg/ha, was 920±220 kg/ha., whereas the mean response to nitrogen over all levels of phosphate and potash when no zinc was applied, was 240±220 kg/ha. In general, yield was depressed when both nitrogen and zinc were applied at their higher levels (50kg N/ha+0.25kg Zn/ha), or at their lower levels (30 kg N/ha + no zinc).

The treatments (in kg/ha):

30N: 50P: 100K: 0.25Zn (A) and
30N: 100P: 100K: 0.25Zn (B)

were not significantly different in yield, but treatment A was significantly higher yielding than all of the other treatments.

3.2 Relevance of production factors in red bean production on Four Paths Clay

The mean yields of the different treatments are given in Appendix 2. No significant differences between any pair of the treatments was observed.

3.3 Basic fertilizer trial with red bean on Morass Peat Soil

The mean yields of the different treatments are given in Appendix 3.

The main effect of potash was the only significant effect detected. The levels of potash tested were 40kg K_2O/ha and 80kg K_2O/ha (35.7 lbs K_2O/acre and 71.4kg K_2O/acre). The value of the main effect per kg of K_2O applied between 40kg/ha and 80kg/ha was 7.6 kg of grain.

No response to nitrogen, phosphate, and copper were detected, and there were no significant interactions between the different factors. Consequently, it appears that only potash fertilization is indicated for red bean grown on Morass Peat. However, a follow-up experiment to define the response curve for potash fertilization needs to be done to determine yield response at 0kg K_2O/hectare and in order to determine whether or not the response to potash observed in this experiment is not the manifestation of a positive quadratic effect. The levels of potash recommended for follow-up testing are 0, 40, 80kg K_2O per hectare (0, 35.7, 71.4 lbs K_2O per acre), and should be combined with nitrogen at 0 and 20kg/hectare, phosphate at 0 and 40 kg/hectare, and Copper at 0 and 4.5kg/hectare.

3.4 Relevance of production factors in red bean production on Morass Peat

The mean yields of the different treatments are given in Appendix 4. No significant differences between treatments were observed. This study indicates that the Morass Peat when newly reclaimed has ample supplies of nutrients needed for the production of red beans.

These results do not conflict with those obtained in the basic fertilizer trial discussed in 3.3 above, since the zero level of potash was not tested in that study.

3.5 Variety trial with red bean on Morass Peat Soil

The mean yields of the three varieties compared in this trial are given in Appendix 5. No significant differences were observed between the yields of the three varieties tested. The 100-grain weight of these varieties, which is an indicator of grain size, were markedly different. Grain size was smallest with Miss Kelly at 353.7g per 1000-grains. Line 23 had a 1000-grain weight of 382.0g and Line 24--400.3g per 1000-grains. The small grained variety Miss Kelly would on average require approximately 12% less seed by weight to plant a given area.

4. Conclusions and Recommendations

4.1 On Four Paths Clay the fertilizer treatment which appears to be most suitable for red bean production is 30N: 50P: 100K: 0.25Zn (all rates in Kg/ha), equivalent to:

127 lbs Sulphate of Ammonia/acre
(or 58 lbs Urea/acre)
+ 97 lbs Triple Superphosphate/acte
+ 149 lbs Muriate of Potash/acre
+ 1.6 lbs Zinc Chelate (14.2%Z_n)/acre

4.2 None of the factors included in the basic production package either separately or altogether had a significant effect on yield. This observation emphasizes the finding that zinc fertilization (as a foliar spray) at a low nitrogen level could be a critical factor in red bean production on Four Paths Clay.

4.3 The results suggest that no fertilizers are needed for red bean production on newly reclaimed Morass Peat. Definition of the response to potash in the range 0 to 80kg K_2O/hectare is necessary.

4.4 The variety Miss Kelly performed as well as the introduced lines (Line 23 and Line 24) supplied by CIAT. This test should be followed-up by small scale semi-commercial trials to identify which of these varieties is easiest to manage.

4.5 Simple cropping systems on the Morass Peat need to be investigated, e.g.

November/December - March/April	: Rice
April - June	: Red Bean
June/July - October/November	: Rice

APPENDIX I

Mean yields of treatments in the basic fertilizer trial with Red Bean on Four Paths Clay

Treatment kg/ha				Mean Yield	
N	P_2O_5	K_2O	Zn	tonne/ha	Statistical group
30	50	100	0.25	3.595	a
30	100	100	0.25	2.825	ab
50	50	100	0	2.195	b
50	100	50	0	2.045	b
30	50	50	0.25	1.995	b
0	0	0	0	1.825	b
50	100	50	0.25	1.775	b
50	50	100	0.25	1.615	b
50	50	50	0.25	1.605	b
30	100	50	0.25	1.595	b
50	50	100	0	1.565	b
30	50	100	0	1.515	b
50	100	100	0.25	1.510	b
30	100	50	0	1.490	b
30	100	100	0	1.475	b
50	100	50	0	1.465	b

Standard error of a treatment mean: ±0.439 tonne/ha. Statistical grouping determined using Duncan's Multiple Range Test (Error d.f. = 14).

APPENDIX 2

Mean yields of treatments in the relevance of production factors experiment with red bean on Four Paths Clay

Treatment	Mean Yield (tonne/ha)	Statistical Grouping
BPP	1.98	a
BPP-N	1.95	a
BPP-P	2.08	a
BPP-K	1.83	a
BPP-Insecticide	2.17	a
BPP-Fungicide	1.85	a
BPP at lower planting density	1.64	a
Untreated (variety only)	1.98	a

Standard error of a treatment mean =±0.22 tonne/ha. Statistical grouping determined by Duncan's Multiple Range Test (Error d.f.=21)

APPENDIX 3

Mean yields of treatments in the basic fertilizer trial with Red Bean on Morass Peat Soil

Treatment kg/ha				Mean Yield	Statistical grouping
N	P_2O_5	K_2O	Cu		
20	40	80	0.25	3.00	a
20	40	80	0.50	2.85	a b
40	80	80	0.25	2.68	a b
20	80	80	0.50	2.63	a b
40	80	40	0.25	2.62	a b
40	80	40	0.50	2.47	a b
20	80	80	0.25	2.46	a b
40	40	80	0.25	2.43	a b
40	80	80	0.50	2.40	a b
40	40	40	0.50	2.38	a b
40	40	80	0.50	2.28	a b
20	80	40	0.50	2.28	a b
20	80	40	0.25	2.23	a b
20	40	40	0.50	2.18	a b
20	40	40	0.25	2.11	a b
40	40	40	0.25	2.03	b

Standard error of a treatment mean: ±0.26 tonne/ha. Statistical grouping determined by Duncan's Multiple Range Test (Error d.f.=14).

APPENDIX 4

Mean yields of treatments in the relevance of production factors experiment with red bean on Morass Peat soil

Treatment	Mean Yield (Tonne/ha)	Statistical Grouping
BPP	2.54	a
BPP + Mn	2.62	a
BPP - N	2.56	a
BPP - P	2.52	a
BPP - K	2.88	a
BPP - Insecticide	3.01	a
BPP - Fungicide	2.71	a
BPP at lower planting density	2.38	a
Untreated (variety only)	30.4	a

Standard error of a treatment mean: ±0.18 tonne/ha. Statistical grouping determined by Duncan's Multiple Range Test (Error d.f: 16)

APPENDIX 5

Mean yields and duration of flowering of three red bean varieties grown on Morass Peat Soil

Variety	Period from sowing to Flowering (days)	Mean Yield (tonne/ha)	Statistical grouping
Miss Kelly	35	1.61	a
Line 23	39	2.13	a
Line 24	39	2.17	a

Standard error of variety mean: ±0.16 tonne/ha. Statistical grouping determined using Duncan's Multiple Range Test (Error d.f.=14)

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FECHA DE DEVOLUCION			

Autor	SUPPLEMENTARY REPORT ON THE APPLIED RESEARCH WORK CARRIED OUT WITH RED
Título	BEANS...

Fecha Devolución	Nombre del solicitante